

# MIETE MASTER IN INNOVATION AND TECHNOLOGICAL ENTREPRENEURSHIP

**Sources of financing and performance metrics in  
early-stage start-ups**

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**Dissertation**

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## Abstract

On the one hand, a crucial component of every entrepreneurial firm and its performance is the access and availability to sufficient capital. On the other hand, various scientists from different disciplines have devoted themselves to answer the question of how the performance of established ventures can be measured. However, little work exists on the relationship between the access to external financing sources and the performance of an early-stage start-up. The most important determinants of performance in the literature are financial performance measures such as sales growth or employee growth. Nevertheless, these metrics are not suitable if applied to an early-stage start-up. The combination of different environmental, organizational or individual factors requires a conceptual framework that links entrepreneurial orientation with performance measurement. It is therefore necessary to explore the interplay between sources of financing, entrepreneurial orientation and performance metrics in start-up companies.

This dissertation presents a start-up performance metric framework, that allows to assess start-up performance in the different investment stages. The research aims to provide insight into different dimensions of performance metrics and how they may be connected to the sources of financing of 7 web, mobile & software start-ups incubated in the start-up incubator of the University of Porto in Portugal. Furthermore, the document sheds light on how the entrepreneurial orientation construct might be associated with the performance of an entrepreneurial firm.

The results show that not only the amount of raised capital is important, but also that particular sources of financing have an advantageous impact in boosting start-up performance. In the early-stage, the entrepreneurs want to control their business and prefer personal savings, bank and personal loans. The performance metrics in the pre-seed stage are mainly related with the product and engagement. The type of performance measurements changed in the seed stage. Business and financial metrics became more important. In the expansion stage, the requirements on the sources of financing changed. Networking, expertise and growth can be better achieved through venture capital or business angel capital. In the Start-up stage, business and financial metrics were clearly the most important metrics. Strongly innovative start-ups tended to have proclivity for product and engagement metrics. Strongly competitive aggressive companies focused on metrics related to their market. Firms that prefer to take less risk valued conventional business metrics.

**Keywords:** Entrepreneurial finance; start-up performance; entrepreneurial orientation; early-stage start-ups; performance metric framework, investment stage

**JEL-Codes:** L26, L25, M13, G24, G30

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## List of abbreviations

<b>B2B2B</b>	Business to Business to Business
<b>B2B2C</b>	Business to Business to Consumer
<b>CEO</b>	Chief Executive Officer
<b>EO</b>	Entrepreneurial Orientation
<b>IEFP</b>	Instituto do Emprego e Formação Profissional
<b>INESC</b>	Instituto de Engenharia de Sistemas e Computadores
<b>IPO</b>	Initial public offering
<b>MVP</b>	Minimum viable product
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>QREN</b>	Quadro de Referência Estratégica Nacional
<b>R&amp;D</b>	Research & development
<b>UPTEC</b>	Science and Technology Park of University of Porto
<b>VC</b>	Venture Capitalist

## 1 Introduction

*The introduction sets the stage for a better understanding of the motivation and background regarding the sources of financing, entrepreneurial orientation and performance metrics of start-ups. The reasons why these areas are spotlighted are described and the research purpose, questions and design are presented. The outline of the dissertation provides an overview of the different sections of the research.*

### 1.1 Motivation

The decision to focus this dissertation on sources of financing and performance metrics of early-stage start-ups is motivated by the author's working experience in various start-up companies. One of the main challenges for the new ventures was financing the daily operations. Not striving for access to external financing limited the companies to internal financing sources such as personal savings or retained earnings which led to a deceleration of growth and a deterioration of performance.

It is therefore necessary to explore and study the interplay between sources of financing, entrepreneurial orientation and performance metrics in start-up companies.

The main outcome of this research is this dissertation. Another outcome was a research-in-progress conference paper that was presented at the XXVII ISPIM Innovation conference in Porto, Portugal on 19-22 June 2016. The paper is attached in the appendix.

### 1.2 Background

According to literature a crucial component of every entrepreneurial firm and its performance is the availability and access to sufficient capital (Marlow and Patton, 2005; La Rocca, La Rocca and Cariola, 2011). One of the most essential questions of microeconomic entrepreneurship research is how entrepreneurial firms are financed (Cassar, 2004), but it is still inconclusive how early-stage investors impact start-ups with their investments (Kerr, Lerner and Schoar, 2014). Especially for early-stage high-tech start-ups it can be a challenge to obtain financial capital from resource providers (Hsu, 2004; Revest and Sapio, 2012). The financing sources of innovative new ventures should be studied, because these start-ups foster innovation and provide notable employment growth (Cassar, 2004). Bank credits as well as venture capital are monitored diligently by investors, because start-ups have an inherent high risk of failure. Not only nascent entrepreneurs face problems to obtain financing, the issue is even more problematic for renascent entrepreneurs, who have been involved in an insolvency (Wakkee and Sleenbos, 2015). In addition, the capital providers often constrain the entrepreneurs' ability to receive financing from other sources (Winton and Yerramilli, 2008).

Researchers from different disciplines have devoted themselves to answer the question of how the performance of established ventures can be measured (Neely, 1999). However, the literature on performance measurement consists mainly of performance metrics that are suitable for companies in a later stage and not for early-stage start-ups. Fraser, Bhaumik and Wright (2015) created an integrated framework relating entrepreneurial finance and a firms' growth. The authors show that only little work exists on the relationship between the access to external financing sources and the growth of the new venture. Firm growth is used in various studies as indicator for business performance (Brush and Vanderwerf, 1992; Chandler and Hanks, 1993;

Fombrun and Wally, 1989, Tsai, MacMillan and Low, 1991). However, the analysis of the growth of a start-up company is quite different from the analysis of the growth of established ventures (Gilbert, McDougall and Audretsch, 2006).

The combination of different environmental, organizational or individual factors have led to a lack of consensus in entrepreneurship literature, which makes it particularly difficult for researchers to explore the relationship between performance and entrepreneurship (Lumpkin and Dess, 1996). Lumpkin and Dess' (1996) conceptual framework links entrepreneurial orientation with the key variables environmental factors, organizational factors and performance. Wiklund and Shepherd (2005) note that it is beneficial to integrate various dimensions of performance in empirical research, due to the multidimensionality of performance. There is still only little known about new venture growth, mainly because each study focuses only on a fraction of variables of the other studies (Wiklund, Patzelt and Shepherd, 2009).

Against this background, the research asks for an environment with a high density of early-stage start-ups. Business incubators provide administrative services such as work space or shared equipment for nascent businesses and help new ventures with the development the business (Grimaldi and Grandi, 2005). Especially university business incubators foster the development of research and technology-based new ventures (Mian and Oswego, 1996). Hence, the research will be pursued in the incubator of the University of Porto (UPTEC) in Portugal. The majority of the start-ups in UPTEC operate in technology specialized fields such as web, mobile & software. The software industry accounts for 36% of total venture capital that exits globally (European Commission, 2015) and received in 2015 the highest amount of venture capital investments of all industries in the United States (Statista, 2016). The industry is therefore highly relevant for entrepreneurs in the search for financing as well as for investors.

### **1.3 Research Purpose**

The purpose of this study is to provide an understanding of the sources of financing and their impact on the performance of early-stage start-ups that operate in the web, mobile & software industry.

Due to the lack of research on how performance in an early-stage start-up can be measured, one of the main objectives of the research is to develop a start-up performance framework, that allows to assess start-up performance in different investment stages. The results presented in this research aim to provide insight into different dimensions of performance metrics and how they may be connected to the sources of financing of web, mobile & software start-ups in different investment stages.

By studying the sources of financing of early-stage start-ups in the web, mobile & software industry, the thesis adds evidence to the relationship between sources of financing and the performance of new ventures. The research provides deeper insight into how early-stage start-ups are impacted by different sources of financing.

Ultimately, the research answers the enduring call for qualitative research on entrepreneurial orientation (Wales, 2016) and sheds light on how the entrepreneurial orientation construct might be associated with the performance of a firm.

## 1.4 Research Questions

The research aims to describe:

- (i) What sources of financing web, mobile and software companies in UPTEC utilize to counter the lack of finance;
- (ii) how web, mobile & software start-ups in UPTEC measure their performance and what performance metrics they use; and
- (iii) the perception of the CEO's regarding the relationship between the sources of financing and their impact on the performance of the new venture; and
- (iv) compare the entrepreneurial orientation of the start-ups in the pursuit of linking the former with sources of financing and performance analysis.

## 1.5 Research Design

This research utilizes a qualitative and inductive-exploratory research design in the form of case studies. Personal interviews with the co-founders & CEOs of a sample of web, mobile & software start-ups incubated in the Science and Technology Park of the University of Porto (UPTEC) in Portugal allowed to obtain data on the entrepreneurial orientation, sources of financing and to theorise and discuss the performance analysis. The research design phases are presented in Table 1.

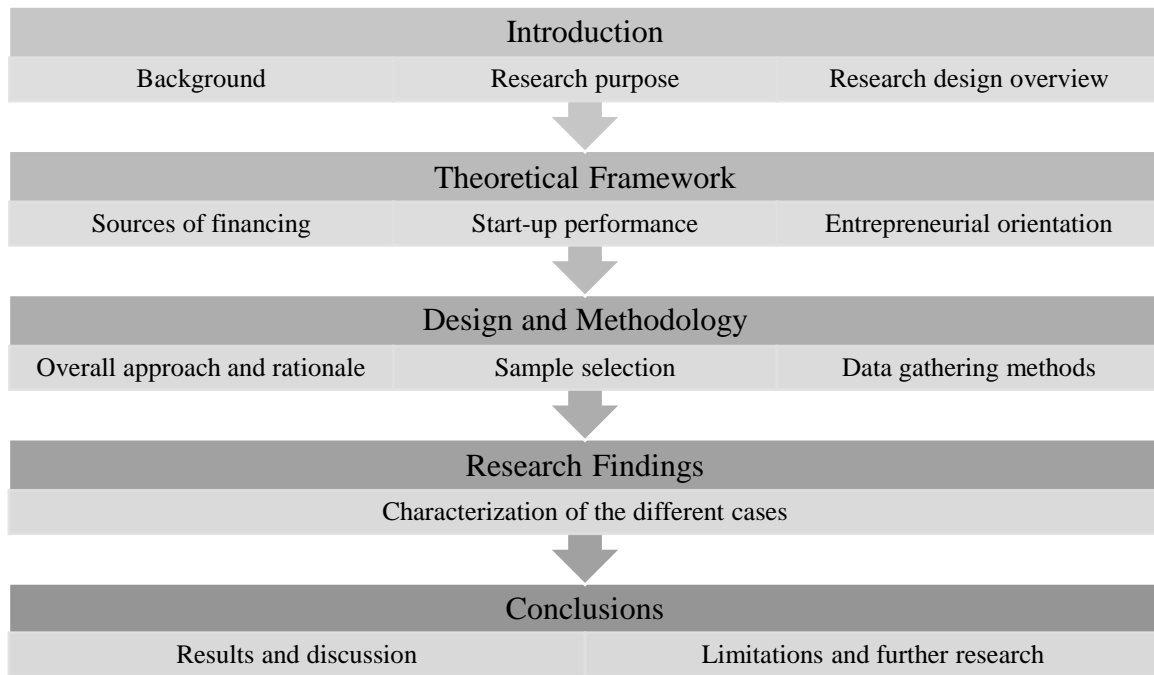
Phase	Objective	Output
Phase 1	Literature review of the main topics: Sources of financing, start-up performance and entrepreneurial orientation	Overview of sources of financing, a framework for start-up performance analysis
Phase 2	Pre-test of the framework with a CEO of a start-up	Feedback from an entrepreneur and improved start-up performance framework
Phase 3	Interview with director of UPTEC	Suitable web, mobile & software companies in UPTEC to apply the research study
Phase 4	Conduct the case studies with entrepreneurs	Sample of 7 start-up companies (selected in Phase 3)
Phase 5	Conclusions	Answer the proposed research questions

**Table 1:** Research design phases

## 1.6 Outline

The introduction of the thesis sets out the background of entrepreneurial finance and performance measurement in start-ups. The purpose and the research questions of the thesis are outlined and the methodology clarifies the research methods of the thesis. In the theoretical framework, different sources of financing according to the literature are identified. Furthermore, the term start-up, the investment stages and various dimensions of performance are defined. The theoretical framework section is concluded with a characterization of the concept of entrepreneurial orientation. In the next chapter, the research design and the methodology are described in detail. After that, the research findings are presented. Then the results are discussed and the research questions are answered. The thesis concludes with the limitations of the research and further research.

Figure 1 show an overview of the different sections of the thesis.



**Figure 1:** Overview of the different sections of the thesis

## 2 Theoretical Framework

*The theoretical framework sheds light on the concepts of start-ups and investment stages. Furthermore, the most important sources of financing and performance metrics regarding the literature are examined and the concept of entrepreneurial orientation is described.*

### 2.1 Definition of a start-up and investment stages

#### Definition of a start-up

Miller (1983, p. 771) defines an entrepreneurial firm as “one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with “proactive” innovations, beating competitors to the punch.” Klotz, Hmieleski and Bradley (2014) define a new venture as a corporation in its early development and growth stages. For Blank (2010) a start-up is “an organization formed to search for a repeatable and scalable business model.” Alternatively, lifestyle-businesses might not need a high investment and tend to have a product that is narrowly defined and requires a strong focus on customer relationships (Morris, Schindehutte and Allen, 2005). For the purposes of this research start-ups are entrepreneurial firms that have an orientation on growth and scalability. The terms “start-up”, “new venture” and “entrepreneurial firm” are used interchangeably throughout this research

#### Definition of investment stages

Start-ups run through an early-stage, expansion stage and a later stage. The early stage of the firm involves the pre-launch and the launch of the product (OECD, 2015a) and includes the two sub-stages pre-seed/acceleration phase and the seed stage. The pre-seed/acceleration phase is the embryonic stage of the business, where the business idea and the intellectual property is developed, which might result in an alpha version or a minimum viable product at the end of the phase (Calacanis, 2015). In the seed investment stage, the financing is used to launch production and to convert the business idea into a market-ready product (Caselli, 2010). The firm is incorporated and the funding is used to create initial product traction (Calacanis, 2015). Early stage investments such as pre-seed and seed could materially differ in approach and volume of the investment across different countries (OECD, 2013). After the early phase, a firm enters the expansion phase, where it requires financing for the expansion of the business (OECD, 2015a). The expansion phase consists of the Start-up Stage and the Series B/C stage. The financing of the Series A round is needed to expand the business activity to increase sales and to achieve initial profitability (Caselli, 2010). The Series A provides the funding that is required to scale the product of the venture (Calacanis, 2015). Series B & C is characterized by further growth/scaling, consolidation and even globalization. Start-ups raise a Series B if they want to increase their liquidity or in order to be highly competitive aggressive on the market (Calacanis, 2015). The last stage is the initial public offering. It marks the end of the scale and transforms a privately held company in a public company.

The characteristics of each stage have changed throughout the last decade. In the past, the pre-seed stage was solely the product idea and the prototype was only built in the seed phase. The funding of Series A was used to launch the product, whereas a B round was utilized to create product traction. Series C provided the necessary capital to scale the business (Calacanis, 2015).

Investment stages are not clearly defined in scientific literature and diverse variations of the terminologies may be found. Some companies might skip the pre-seed/acceleration investment stage and raise immediately a seed round and others might raise a mezzanine or bridge round

between investment rounds. The focus of this research is early-stage start-ups, therefore these stages have not been taken into account.

According to the definitions, Table 2 shows an overview of the different investment stages with typical but not specific characteristics for each investment stage.

Investment Stage	Characteristics	Stage
<b>Pre-seed/ Acceleration</b>	<ul style="list-style-type: none"> <li>○ Idea phase</li> <li>○ IP development</li> <li>○ Alpha/MVP launch</li> </ul>	Early Stage
<b>Seed</b>	<ul style="list-style-type: none"> <li>○ Product/market fit</li> <li>○ Initial traction</li> <li>○ Incorporation</li> </ul>	
<b>Start-up (Series A)</b>	<ul style="list-style-type: none"> <li>○ Monetization</li> <li>○ Traction increase</li> <li>○ Internationalization</li> </ul>	Expansion Stage
<b>Series B &amp; C</b>	<ul style="list-style-type: none"> <li>○ Growth/scaling</li> <li>○ Globalization</li> <li>○ Consolidation</li> </ul>	
<b>IPO</b>	<ul style="list-style-type: none"> <li>○ Initial Public Offering</li> <li>○ Sells stocks to the public</li> </ul>	Later Stage

**Table 2:** Overview of investment stages

## 2.2 Sources of financing

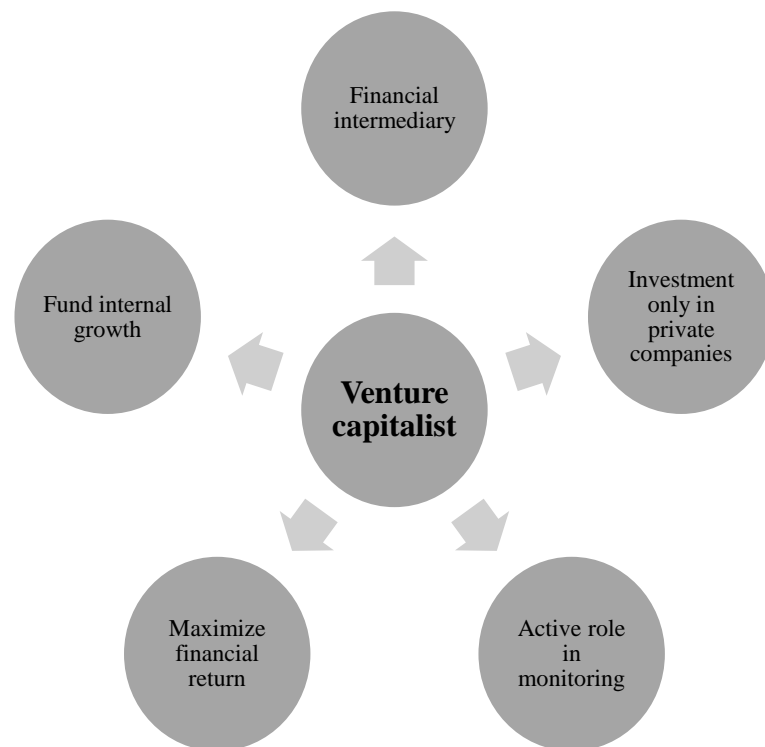
*The sources of financing that will be examined for this research are venture capital, business angel capital and a selection of other sources of financing.*

### 2.2.1 Venture capital

Black and Gilson (1998, p. 245) define venture capital as “*investment by specialized venture capital organizations (...) in high-growth, high-risk, often high-technology firms that need capital to finance product development or growth and must, by the nature of their business, obtain this capital largely in the form of equity rather than debt.*” Achleitner (2001) defines venture capital as the financing of a privately held company with equity. Furthermore, Achleitner points out that the term ‘venture capital’ is subject to the investment stage of the company. Whereas venture capital *sensu stricto* means the financing of new ventures, it is referred to the participation in established companies as ‘private equity investment’. Companies that receive venture capital are generally young and small and exhibit large information asymmetries between investors and entrepreneurs. (Gompers and Lerner, 2001). Venture Capital is very well developed in Europe. 13 out of 20 countries with the highest VC investment in relation to GDP are located in Europe (Bertoni, Colombo and Quas, 2015).

Metrick and Yasuda (2011) identified five main characteristics of venture capital. Figure 2 shows an overview of the characteristics of venture capital. The venture capital firm acts as financial intermediary, as the firm uses the capital of the investors to invest in portfolio companies. Those companies are typically only private companies and the venture capitalist monitors and helps the entrepreneurs with the business development. The investment is made to fund the internal growth of the start-up, and the main goal of the venture capitalist is to maximize the financial return through a sale of the company or an initial public offering (Metrick and Yasuda, 2011).

Hellmann and Puri (2000) define venture capitalists as professionals, that work full-time as investors for partnership funds, who are specialized in the financing of new ventures. “*Venture capital organizations finance (...) high-risk, potentially high-reward projects, purchasing equity or equity-linked stakes while the firms are still privately held*” (Gompers and Lerner, 2001, p. 145). Venture Capital firms are shaping the environment within start-ups are created (Baum and Silverman, 2004). Venture Capitalists (VCs) contribute not only with financial resources but also add value through other activities that have a positive effect on the firms’ performance (Croce, Martí and Murtinu, 2013). According to Baum and Silverman (2004) it is not very well understood how VCs actually enhance the performance of a start-up. It remains unclear, why companies that received venture capital tend to grow faster than companies that did not receive venture capital. The increase in growth might be due to the value that the VCs add to the company or an instinctive feeling of the VCs to pick the most auspicious entrepreneurs (Revest and Sapio, 2012).



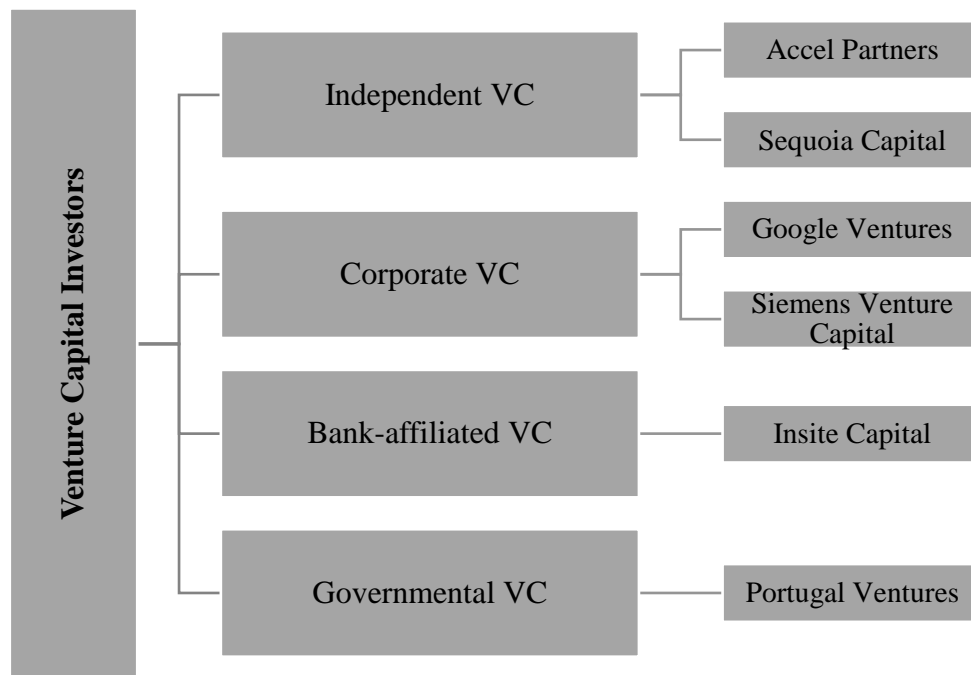
**Figure 2:** Characteristics of venture capital

(Source: Own Illustration based on Metrick and Yasuda’s (2011) main characteristics of a VC)



There are various forms of venture capital investors due to diverging configurations of governance and ownership (Bertoni et. al., 2015). VC investors can be divided into independent VC's, which are investors who act as general partners in a limited partnership (Sahlman, 1990). Examples for independent VC's are [Accel Partners](#) or [Sequoia Capital](#). Further, there are corporate VC's such as [Google Ventures](#) or [Siemens Venture Capital](#), bank-affiliated VC ([Insite Capital](#) by [Chemical Bank](#)) and governmental VC ([Portugal Ventures](#)).

Figure 3 illustrates different types of VCs and examples thereof.



**Figure 3:** Different types of venture capitalists

(Source: Own Illustration based on Bertoni et. al.'s (2015) different VC types)

Entrepreneurial firms often face financial constraints, which could be solved through venture capital (Hirukawa and Ueda, 2011). Both academics and entrepreneurs consider venture capital as one of the most important drivers of the success of a start-up (Wright and Robbie, 1998; Hellmann and Puri, 2000). Kenney (2011) posited that leading technology companies in the United States were founded by venture-capital backed entrepreneurs and that venture capital has evolved to a much favoured method to fund entrepreneurial firms.

However, the relationship between venture capital investment and prosperous outcomes for a new venture depends on if the VC can identify ventures that are likely to have a high-growth in the future, and if the VC adds value to the start-up through management guidance (Baum and Silverman, 2004). There is a lack of research on how venture capital impacts the new venture and what kind of firms are more likely to receive venture capital (Hellmann and Puri, 2000). Gompers and Lerner (2001) posited that one of the barriers in venture capital research is the insufficient access to data and confidentiality issues made the research in this area more difficult.

### 2.2.2 Business angel financing

Business angel financing is one of the main alternatives to venture capital financing and is also at times described as informal venture capital. (Hellmann and Puri, 2000; Becker-Blease and

Sohl, 2015). In various countries business angel capital is the largest source of external funding of start-ups after funding from family and friends (Avdeitchikova, Landström and Mansson, 2008).

Business angels provide external financing to new ventures and are therefore essential to entrepreneurs (Ding, Au and Chiang, 2015). Mason and Harrison (1995, p. 65) define business angels as “*private investors who provide risk capital directly to new and growing businesses in which they have no family connection*”.

Business angels evolved after the maturation of informal investment markets in developed economies from being solo investors to working with other angel investors in business angel syndicates (Paul and Whittam, 2010). Parhankangas and Ehrlich (2014) found that there is a comprehensive amount of entrepreneurship literature regarding what factors influence the decision of a business angel to invest in a start-up. Past research focused on identifying factors why business angels invest in a venture (Maxwell, Jeffrey and Lévesque, 2011). Researchers face difficulties when studying business angels, because the unknowable population of angels (Farrell, Howorth and Wright, 2008). However, it is estimated that approximately 5.5 billion euros were invested in Europe by business angel networks and individual investors in 2013 (Statista, 2014).

### **2.2.3 Selection of other sources of financing**

Denis (2004) found that it is necessary to analyse alternative sources of financing to comprehend what is driving the allocation in the provision of funding to new ventures. Other sources of financing can help individuals that do not have access to conventional finance sources (Khavul, 2010). Other sources of financing may include, but are not limited to bootstrapping, microfinance, peer-to-peer-lending, government grants, accelerators and crowdfunding. Business angel financing and crowdfunding becoming increasingly widespread in the recent years, but still account for a small proportion of financing sources (OECD, 2016).

Table 3 shows a selection of other sources of financing and typical characteristics.

Source of financing	Capital		Characteristics
	Equity	Debt	
Accelerator	<input checked="" type="checkbox"/>		Business accelerators provide trainings, mentorship, investment and other resources and services to start-ups and help them to develop their business concept in a sustainable way (Bergfeld, 2015). Accelerators select start-ups according their past performance and different qualitative criteria, which sets them apart from other policy programmes, which utilize quantitative metrics to select participant firms (OECD, 2015a).
Bank loan		<input checked="" type="checkbox"/>	A bank loan is debt capital that an entrepreneur receives from a bank. Lately, more banks offer programs for small businesses and realize the high market potential of young companies (Entrepreneur.com, 2016).
Bootstrapping	<input checked="" type="checkbox"/>		Start-ups encounter constraints in raising capital from external sources, because of information asymmetries. Some new ventures try to overcome these constraints with bootstrapping. Although bootstrappings' prominence and dissemination among entrepreneurs, (Ebben and Johnson, 2006) little literature exists on understanding how bootstrapping impacts the development of a start-up (Ebben and Johnson, 2006). Financial bootstrapping is a way of meeting the financial demands of a new venture without the use of external debt finance or new shareholders (Winborg and Landström, 2001).
Crowdfunding/ Crowd investing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lately, new ventures can utilize sources of funding such as crowdfunding (Fraser et al., 2015). Crowdfunding allows a new venture to obtain financing from various individuals in exchange for equity, debt or future products (Mollick, 2014).
Micro lending		<input checked="" type="checkbox"/>	The term micro lending was shaped by social entrepreneur Muhammad Yunus, in order to characterise the micro loans which had a vast impact on the lives of entrepreneurs in third-world countries (Festa, Wilson and Neidermeyer, 2010).
Peer-to-peer lending		<input checked="" type="checkbox"/>	Peer-to-peer lending is a new source of financing and so far, only little research has been conducted into the extent of the impact of this new financing instrument (Bruton, Khavul, Siegel and Wright, 2014). It allows individuals to lend money without a bank as a middleman (Zhang and Liu, 2012).

**Table 3:** Selection of other sources of financing

### 2.2.4 Scope of entrepreneurial finance in the literature

In the past, entrepreneurship was viewed in the literature as completely self-contained from the scope of corporate finance (Denis, 2004). Later, financial scholars realized that entrepreneurial finance is characterized by the same problems that mature companies face, but the dimension of these problems in established companies is larger and requires different solutions (Denis, 2004). In particular, Denis (2004) raises the question, whether the source of financing makes a difference for a new venture. It is still inconclusive how early-stage investors impacted start-ups with their investments (Kerr et al., 2014). Ventures in an early phase commonly show a deficit in cash flows and utilize financing sources such as bootstrapping, subsidies, business angels, incubators, early stage venture capital or strategic investors (OECD, 2013).

Fraser (2015) created an integrated framework relating entrepreneurial finance and a firms' growth. The authors show that, little work exists on the relationship between the access to external financing sources and the growth of the new venture. Fraser's framework shows that ventures that want to foster dynamic growth are more likely to follow an external finance tendency, whereas lifestyle businesses are more likely to follow an internal finance tendency. Besides the growth orientation, the entrepreneurial cognition is also related to the finance tendency, demand and perceptions of supply of finance (Fraser et. al., 2015).

Besides external equity financing, external debt financing is another possibility to finance a venture. However, Wakkee and Sleebos' (2015) study examined data from 608 bankers in the Netherlands in 2007 and analysed their willingness to consider new applications for credits from renascent entrepreneurs. The study shows that a significant part of the credit applications from renascent entrepreneurs do not even go through the first segment of the approval process, because the bankers are consequently rejecting applications from these entrepreneurs.

### 2.3 Definition of performance

Various scientists from different disciplines have devoted themselves to answer the question of how the performance of a business can be measured (Neely, 1999). Wiklund and Shepherd (2005) note that it is beneficial to integrate various dimensions of performance in empirical research, due to the multidimensionality of performance. The prevalent way to assess the performance of a business is to measure the return on investment (Morgan and Strong, 2003). Hughes and Morgan (2007) examined business performance and used customer performance and product performance as dimensions to measure the performance of a business. It is essential for new ventures to attract new customers, achieve repeat orders and to sustain its existing customer base, in order to survive and grow (Hughes and Morgan, 2007). Furthermore, new ventures frequently rely on one main product offering, which makes product performance to a crucial area for the majority of start-ups (Hughes and Morgan, 2007).

Firm growth is used in various studies as indicator for business performance (Brush and Vanderwerf, 1992; Chandler and Hanks, 1993; Fombrun and Wally, 1989, Tsai et al., 1991). Hamilton (2007) divides small business growth study approaches into stochastic, descriptive, evolutionary, resource-based, learning and deterministic groups. The aim of a deterministic growth study approach is to identify explanatory variables that describe the cause of growth (Hamilton, 2007).

The Organisation for Economic Co-operation and Development (OECD, 2007, p. 61) defines a high-growth enterprise as follows:

*“All enterprises with average annualised growth greater than 20% per annum, over a three-year period should be considered as high-growth enterprises. Growth can be measured by the number of employees or by turnover.”* Furthermore, OECD assigns the term “Gazelle” to “all enterprises up to 5 years old with average annualised growth greater than 20% per annum, over a three-year period (...)”.

Coad (2010) looks at the growth of a firm as a multidimensional phenomenon, and views profits, employment, sales and labour productivity as substantially different indicators with individual information about venture growth. However, the growth of a start-up company has different impacts than the growth of established ventures (Gilbert et al., 2006). There is still only little known about small firm growth, mainly because each study focuses only on a fraction of variables of the other studies (Wiklund et. al., 2009). Gilbert et al. (2006) found in their review that the most significant measurements of the growth of a start-up are the market share, employment and the sales of the company. The authors also note that it depends on the type of company and the industry in which the venture operates. The biotechnology industry might spend a considerable amount of time for product development for their market. Hence, rather than using sales growth as an indicator, it might be advantageous to use the growth of employment as an indicator for growth.

Trailer, Hill and Murphy (1996) examined empirical literature regarding the measurement of performance in new ventures. The authors studied what kind and how dimensions of performance were measured. The growth of a new venture besides efficiency and profit were the most observed dimensions of performance. The result of the study was that the most important measures of growth are the change in sales or employees, the market share growth, the increase or decrease of the net income margin or owner compensation or the change in labour expense to revenue (Trailer et al. 1996).

Table 4 shows an overview of the measures of growth dimension and the number of articles that were analysed by Trailer et al.

Nevertheless, these metrics tend not to be suitable if applied to an early-stage start-up and reveal a substantial gap in existing performance literature. The contextual dimensions in the growth literature are often neglected, therefore it is necessary to conduct more research on the entrepreneurial growth process (Wright and Stigliani, 2013). It is becoming more important to not only measure growth through different measurements of growth, but also to theorize different patterns of growth (Wright and Stigliani, 2013). Future research has to take not only ownership and size of the venture into consideration, but also other dimensions of heterogeneity of the firm, because those dimensions might help to define the relationship between financing and growth (Du and Girma, 2012).

Author(s)	Title	Sample	Determinants of business performance
<b>Brush and Vanderwerf (1992)</b>	“A comparison of methods and sources for obtaining estimates of new ventures performance”	66 manufacturing firms, 4-6 years’ old	Annual sales, number of employees, return on sales, growth in sales, growth in employees
<b>Chandler and Hanks (1993)</b>	“Measuring the performance of emerging business: A validation study”	120 manufacturing businesses, founded between 1980 - 1991	Growth, Business volume
<b>Fombrun and Wally (1989)</b>	“Structuring small firms for rapid growth”	95 cross-sectional U.S. firms	Strategic orientation and degree of product diversity
<b>Tsai et. al. (1991)</b>	“Effects of strategy and environment on corporate venture success in industrial markets”	Industrial markets	Culture, climate, corporate support, structure and venturing effort
<b>Morgan and Strong (2003)</b>	“Business performance and dimensions of strategic orientation”	149 high-technology, industrial manufacturing firms, medium and large companies	Return on investment, sales growth, market share, customer satisfaction, competitive position, customer retention
<b>Wiklund and Shepherd (2005)</b>	“Entrepreneurial Orientation and Small Business Performance: A Configuration Approach”	413 Swedish firms from manufacturing, professional services and retail, small businesses	Financial performance measures: cash flow relative to competitors, profit, sales; Growth measures: sales and employee growth, sales and employee growth relative to competitors

<b>Hughes and Morgan (2007)</b>	“Deconstructing the Relationship Between Entrepreneurial Orientation and Business Performance at the Embryonic Stage of Firm Growth”	211 high-technology firms located within business incubators	Customer performance (customer acquisition, customer retention), product performance (sales, market share)
<b>Wiklund et. al. (2009)</b>	“Building an integrative model of small business growth”	413 Swedish firms from manufacturing, professional services and retail, small businesses	Employment growth, sales growth, sales growth compared to competitors, value growth compared to competitors

**Table 4:** Overview of the measures of growth dimension in the literature

## 2.4 Entrepreneurial orientation

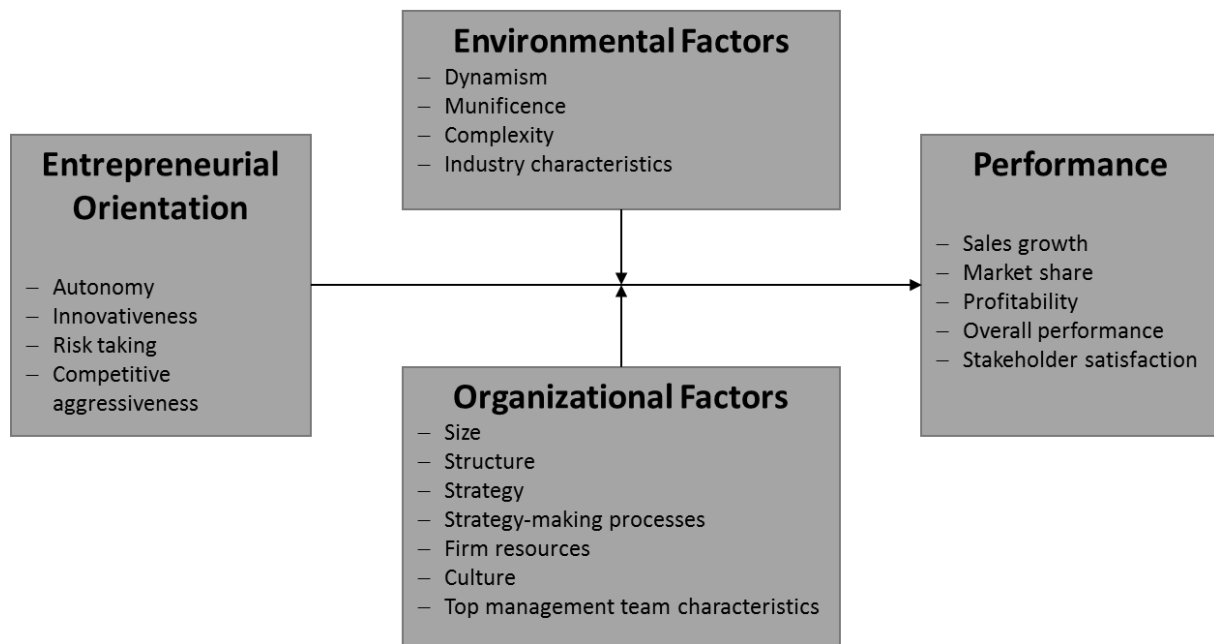
According to Miller (1983) is entrepreneurship closely tied to leader personality, strategy, structure and environment. Lee, Lee and Pennings' (2001) study investigated that the orientation of the entrepreneur has a statistically significant and positive effect on the performance of the venture. A firm's ability to take advantage of entrepreneurial opportunities and driving forward the corporate growth can be an indicator of entrepreneurial orientation effectiveness (Covin, Green and Slevin, 2006). There is an absence of qualitative research on entrepreneurial orientation, although there have been repeatedly calls (Lumpkin and Dess, 1996; Miller, 2011; Wiklund and Sheperd, 2011; Covin and Miller, 2014) for qualitative research to gain more insights (Wales, 2016).

Proactiveness, innovativeness, competitive aggressiveness, risk-taking and autonomy are the five dimensions of the entrepreneurial orientation (Lumpkin and Dess, 2001). Each dimension is measured with different items to measure the orientation. The items were created by Covin and Slevin (1986), and Covin and Slevin (1989) with wording of Khandwalla (1977). Proactiveness is characterized by the way how the firm deals with its competitors. The items of this dimension measure if the firm responds or initiates actions, or if the firm introduces new products or technologies. Moreover, the attitude of the employees is measured to see if they favor to introduce new products or if they prefer to follow the market leader. The dimension of innovativeness is measured by questions regarding the emphasis of research and development and technological leadership and if there have been dramatic changes in the product in the last five years. The competitive aggressiveness of a firm is benchmarked by the attitude if the firm wants to take business from competitors or even undo competitors. The risk-taking dimension measures if the firm prefers high risk projects with chances of a very high return or low risk projects with normal rates of return. In addition, the entrepreneur's orientation regarding incremental or bold behavior is measured and checked if the firm adopts a wait-and see posture or tries to adopt a bold posture to exploit opportunities. The last dimension is autonomy, where it is examined if the firm supports the efforts of individuals or if the individuals have to refer to their supervisors.

Lumpkin and Dess' (1996) conceptual framework links EO with the key variables environmental factors, organizational factors and performance. The role of environmental and organizational factors such as industry characteristics, size and background of the management team have to be taken into consideration to link EO with performance (Lumpkin and Dess, 1996).

Figure 4 shows the interplay between different factors of Lumpkin and Dess' conceptual framework of entrepreneurial orientation.





**Figure 4:** Conceptual Framework of entrepreneurial orientation

(Source: Illustration following Lumpkin and Dess, 1996).

### 3 Design and methodology

*This chapter is dedicated to examine the scientific methods that were utilized for this research. The overall approach and rationale justifies the research design and the sample selection covers the sampling approach and the environment. Ultimately, the data gathering methods are described.*

#### 3.1 Overall approach and rationale

This research utilizes a qualitative and inductive-exploratory research design in the form of case studies.

One of the key features of quantitative research is that it is used to develop predictions and mathematical models. Quantitative research on the one hand is driven by the questions of “how much” and “how often” (Tracy, 2013). Qualitative research on the other hand tends to focus on “how” and “why” questions (Yin, 2003). One of the features of qualitative research is that it represents the perspectives and views of the participants of the study (Yin, 2011). Exploratory studies aim to conduct research on little-understood phenomena and try to discover and identify significant categories of meaning (Marshall and Rossman, 2006). Descriptive studies try to find out what the beliefs, attitudes and processes of the phenomenon are and describe and document it (Marshall and Rossman, 2006).

In the first phase of the research design, based on the selective literature review, a review of different sources of financing and performance metrics was undertaken, to display the most important sources of financing and performance metrics for early-stage start-ups. A review of the concept of entrepreneurial orientation helped to provide a better understanding of the connection of EO and performance. Selective literature reviews help to revise the preliminary considerations regarding the relevance of the study, the data collection method and the sources of the data (Yin, 2011).

Then, a framework which allows to identify and assess performance metrics in an early stage start-up company was developed. The framework was integrated into a questionnaire and was applied in the form of a case study research.

Due to the nature of the proposed research questions, the use of a case study approach was suitable. An inductive explorative research design in the form of a case study was developed. The case study approach aims to establish the operational link between one set of conditions (causes) and their effects. Given the exploratory nature of this study, the cases included in the study were selected with variation, enabling analysis of different ends of the spectrum, as well as identification of important themes (Yin, 2003). Applying a case study approach allows to study processes in a highly detailed and precise way (Flick, 2009).

In phase 2, the questionnaire was pre-tested with a CEO of a start-up that is incubated in UPTEC. Pilot studies provide an opportunity to refine and test aspects of the study (Yin, 2011). The response to the pilot are improbably representative and should not be included in the research findings (Oppenheim, 1992).

This practical feedback from the entrepreneur, entered into the development of an improved start-up performance framework in phase 3. The answers regarding the sources of financing and performance metrics of the pre-test start-up were not included in the research findings.

The interview questions were pre-tested in phase 4 with the executive director of UPTEC, to identify suitable companies incubated in UPTEC. Then, various alterations to the interview guide were made according to the feedback.

Phase 5 included personal interviews with the entrepreneurs and allowed to obtain data on the sources of financing, entrepreneurial orientation and to theorise and discuss the performance quantifications.

The objective of the last phase was to draw conclusions and to answer the proposed research questions.

The research design phases are presented in Table 4.

Phase	Objective	Output
Phase 1	Literature review of Sources of financing & start-up performance	Overview of Sources of financing, start-up performance framework
Phase 2	Pre-test with CEO of a start-up	Feedback from an entrepreneur
Phase 3	Changes on the framework	Improved start-up performance framework
Phase 4	Interview with director of UPTEC	Suitable web, mobile & software companies in UPTEC to apply the research study
Phase 5	Conduct the case study with entrepreneurs	Sample of 7 start-up companies (selected in Phase 4)
Phase 6	Conclusions	Answer the proposed research questions

**Table 4:** Research design phases

### 3.2 Environment & sample selection

UPTEC is the Science and Technology Park of the University of Porto in Portugal. UPTEC's mission is *“to foster the creation of technology-based companies and creative business and attract innovation centers, supporting an effective knowledge and technology transfer between academia and the market”* (Science and Technology Park of the University of Porto, 2016). The incubated companies in UPTEC are divided in different categories depending on the field of operation. Ventures working in the biotechnology/healthcare sector are allocated to UPTEC BIO, companies from creative industries are located in UPTEC PINC and companies in the nautical industry in UPTEC MAR. The biggest centre of UPTEC is UPTEC TEC with companies operating in web, mobile, software and other areas. It is located in close proximity the most important research institutes and technological schools of the University of Porto. UPTEC TEC provides support, technological equipment and infrastructure to 100 start-ups every year. UPTEC divides its incubation process in pre-incubation, incubation and internationalization and on average it takes 3 years from the admission until the end of the incubation process. The services that UPTEC provides the Incubatees include inter alia meeting & training rooms, reception, a voice connection network, data infrastructure, maintenance and cleaning (Science and Technology Park of the University of Porto, 2016).

Given that the majority of the start-ups in UPTEC operate in technology specialized fields, the sample contains only companies that operate in this specialized field. Purpose sampling was applied in order to find suitable start-ups incubated in UPTEC. The interview questions were pre-tested with the executive director of UPTEC, to identify suitable companies incubated in

UPTEC and to ensure content validity. The intensity of required features and experiences is an appropriate sampling approach for a case study (Flick, 2009).

Considering the goals of the study, the criteria for start-ups were:

- (a) incubated in UPTEC;
- (b) working in the field of web, mobile or software; and
- (c) have multiple sources of financing

13 start-ups were selected during the sampling interview with the executive director of UPTEC. Among these 13 firms, 7 companies (53,84%) were willing to take part in an interview. The identity of the selected companies was not disclosed to protect the confidentiality as a participant in this study.

### 3.3 Data gathering methods

In-depth interviews with the responsible persons (CEOs & Co-Founders) of all suitable companies incubated in UPTEC were conducted. Interviews can help to discover, understand and explain viewpoints and experiences in an organic or adaptive way (Tracy, 2013). Structured interviews use a formal questionnaire and list all questions. The Interviewer will try to get answers from the Interviewee and will try to adopt a consistent behavior for every participant of the study (Yin, 2011). The interviewee should be sufficiently informed and must be capable to give consent for the participation in the study (Flick, 2009). The questionnaire that was used during the in-person interviews included questions regarding the organizational and environmental factors of the start-up, the entrepreneurial orientation, the performance measurements and the sources of financing. Table 5 shows an overview of the topics of the interview questions. The full interview guide is attached as Appendix 3. All interviews were conducted with the Co-Founder & CEO of the respective start-up and lasted between 30 and 90 minutes. Six interviews were carried out in the offices of the companies. One interview was conducted over Skype. All interviews were recorded on audio and then transcribed word for word shortly after the interview.

1. Organizational & Environmental Factors	2. Entrepreneurial Orientation	3. Performance measurements	4. Sources of financing
Year of foundation	Proactiveness	Performance metric framework	Sources of financing framework
Area of operation	Innovativeness	We should have measured	Impact on performance
Number of employees	Competitive Aggressiveness		Smart Capital
Background of founders	Risk Taking		
Investment stage	Autonomy		

**Table 5:** Overview of the different sections of the interviews

Personal interviews with the entrepreneurs allowed to obtain data on the entrepreneurial orientation. In order to explore the relation between performance and entrepreneurial cognition Lumpkin and Dess' (1996) entrepreneurial orientation model was utilized. A seven-point Likert scale was used to measure the tendencies of the entrepreneurs to different statements regarding proactiveness, innovativeness, risk-taking, competitive aggressiveness and autonomy. Likert scales display a number of attitude dimensions and the respondent gives scores on how strongly they agree or disagree to a series of positions (Brace, 2008). For the purpose for this research, the wording of Khandwalla (1977) for some of the items was slightly changed in order to be applicable to start-up firms. The response sets were varied to avoid leading respondents to an answer to present their start-up in a more favorable light.

The entrepreneurial orientation literature in the past exclusively utilized quantitative approaches. For the present qualitative approach, radar charts were used to illustrate the different tendencies of EO dimensions. For example, 1 would be a strongly innovative start-up, whereas 7 would be a strongly customary start-up. The full entrepreneurial orientation questionnaire and the Likert scale itemization with the explanation of each value are attached as Appendix 1 & 2.

## 4 Research Findings

*In this chapter, the major findings of the empirical research are presented. The characteristics of each start-up are presented and then the sources of financing, performance measurements and entrepreneurial orientation of each start-up are described in detail.*

### 4.1 Start-up Alpha

*“A balanced allocation of the sources of financing is essential for a Start-up”.*

**CEO and Co-Founder of Start-up Alpha**

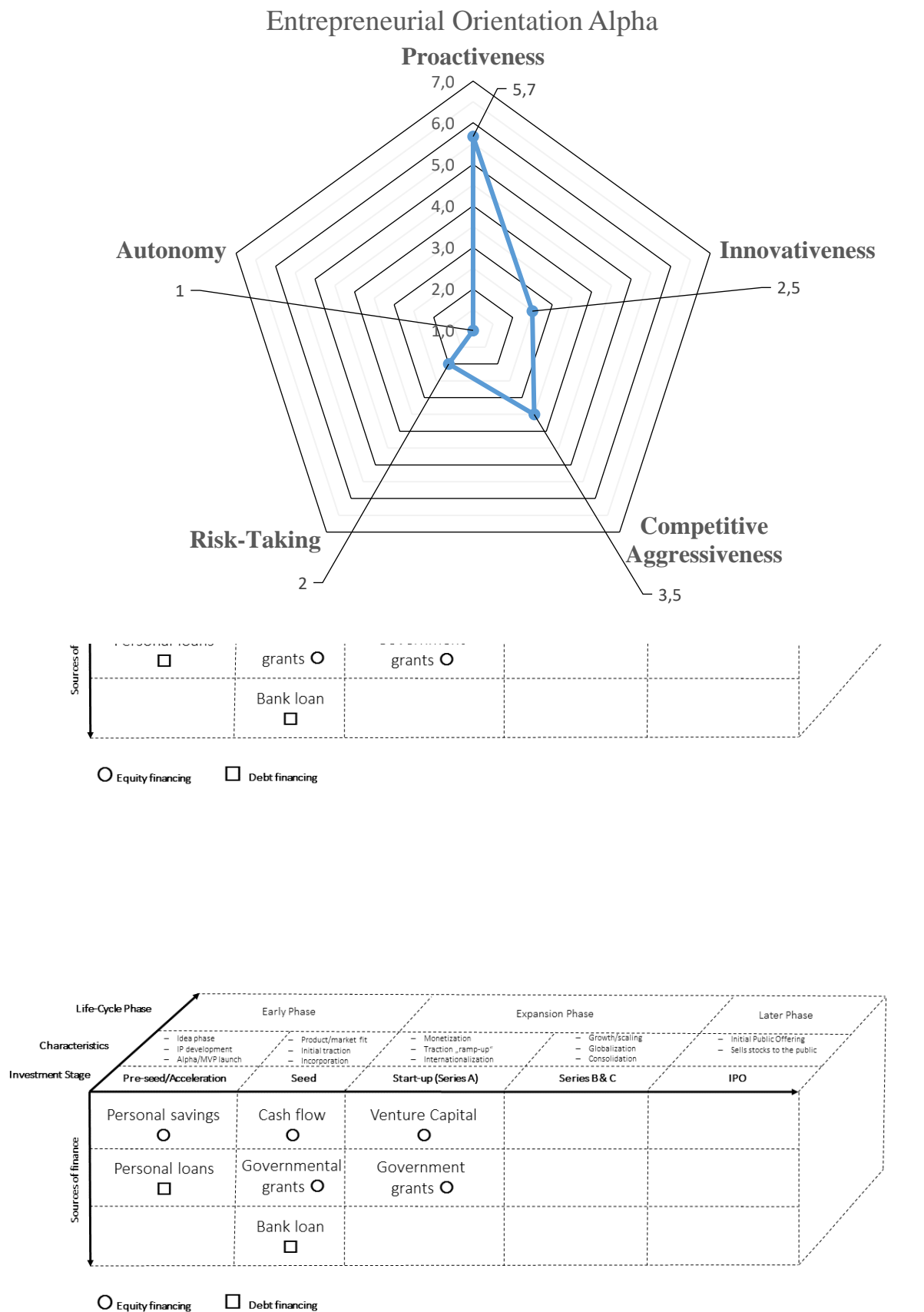
#### Background

Start-up Alpha develops solutions for digital marketing in the areas web & mobile. The firm was founded in the year 2007 by two software engineers and an industrial engineer. The company failed with its first product and pivoted to something completely different. In 2016 the company had 70 employees and was in the Series B & C investment stage. The interview was conducted in the company's office in UPTEC in Porto.

#### Entrepreneurial orientation characterization

Alpha can be described as a quite proactive start-up. With an proactiveness value of 5.7 it corresponds to the average proactiveness score (5.7) of all cases. The innovativeness score 2.5 indicates that the start-up can be still seen as a quite innovative start-up. The score is marginally higher than the average innovation score of 2.4. Alpha is slightly competitive aggressive with a competitive aggressiveness score of 3.5. The average score of 3.2 shows that other start-ups in the sample tend to be slightly more aggressive on the market. In terms of risk-taking, Alpha can be described as a firm with a quite high proclivity for high-risk projects. The risk-taking value of 2.0 is significantly lower than the average score of 2.7. That shows that other start-ups in the sample tend to take less risks. Furthermore, has Alpha the highest score (1.0) for autonomy. The average value is 2.6. Alpha is the firm that supports the efforts of individuals the most.

Figure 5 illustrates the entrepreneurial orientation of Start-up Alpha.



**Figure 6:** Overview of the Sources of financing of Start-up Alpha

*“Every source of financing was important, and all of them had a strong impact on our growth”, says the CEO of Start-up Alpha. “However, the most important sources of financing for us were*

*the bank loan and venture capital.*” The entrepreneur thinks that if a start-up can take out a credit loan, it should take the opportunity. *“The bank loan gives you more control over your business and that is very important”*. In the CEO’s opinion, venture capital is more expensive than a bank loan in the end. Nevertheless, the entrepreneur reckons that venture capital is important in terms of the valuation of the company and that start-ups might be able to obtain a higher amount of money from a VC than from a bank.

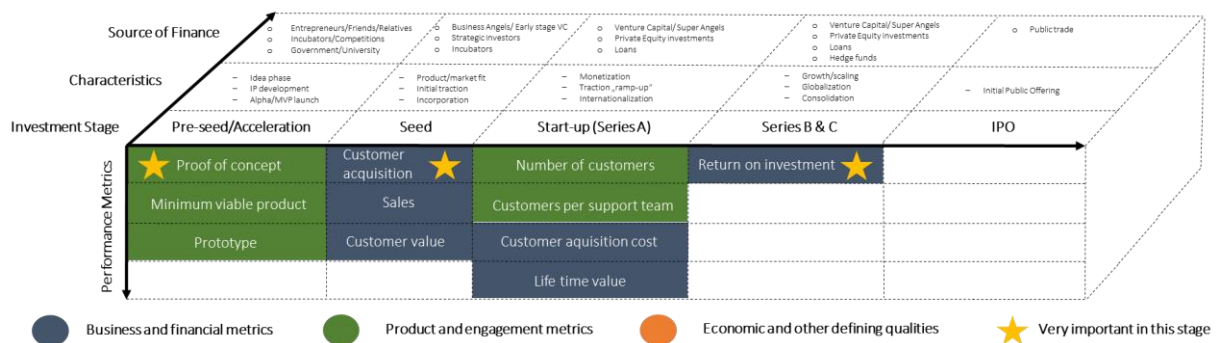
The CEO believes that smart capital is only limited available in Portugal. *“Obtaining capital is not a big problem, but Portugal lacks smart capital, because the start-up ecosystem is quite new and there are not that many exits”*.

#### Performance measurements characterization

After Alpha failed with its first product, it was particularly important to validate the new product in the pre-seed stage. The company built a minimum viable product/prototype to be able to start testing the product on the market. The metrics in the pre-seed stage were solely related to the product and the engagement with it. After validating that there is a demand for its product, customer acquisition became the most important metric for the company in the seed stage. It would be necessary to find out how much the customer is willing to pay for the product: *“It’s important to know how much customers value your product, to define a price point.”* In the Start-up investment stage, the number of customers became more important, as well as customers per support team, customer acquisition cost and life time value. The company started to measure return on investment in the Series B investment stage.

The CEO thinks that his firm should have measured return on investment as soon as they had sufficient data. It would allow the firm to scale up with more confidence.

Figure 7 shows an overview of the performance metrics that were utilized by Start-up Alpha.



**Figure 7:** Overview of performance metrics of Start-up Alpha

## 4.2 Start-up Beta

*“A non-disclosure agreement with BMW is a performance metric.”*

**CEO and Co-Founder of Start-up Beta**

#### Background

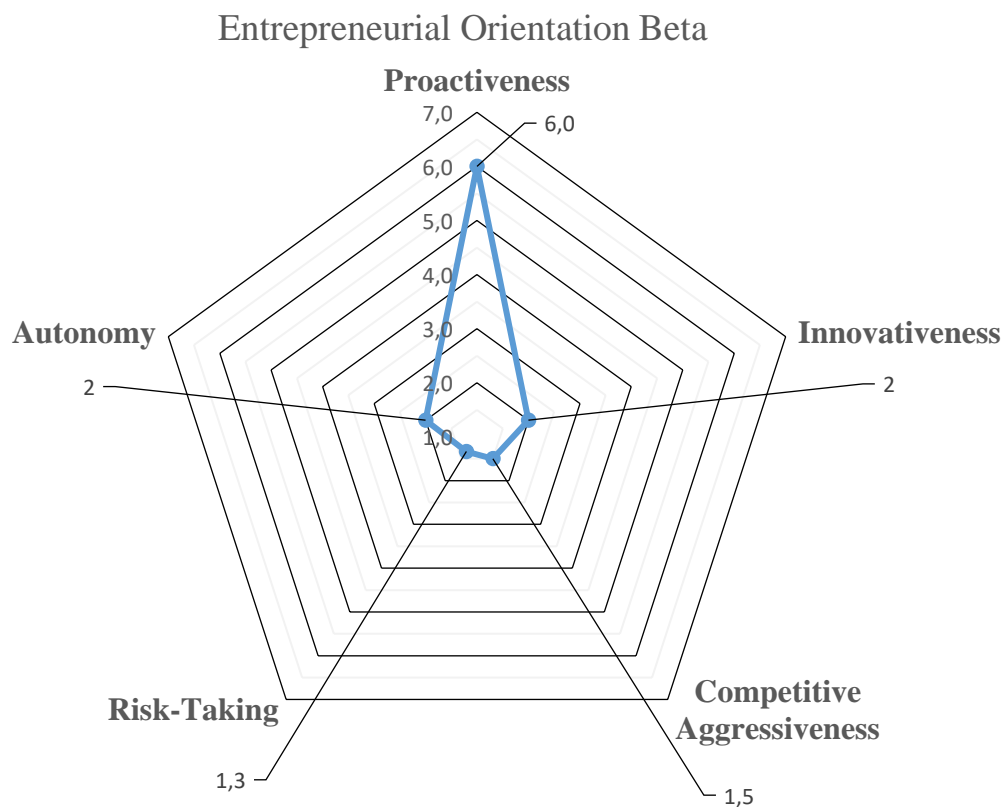


Start-up Beta develops biometrical software for the automotive, security and health sector. The core business of the firm is software, but Beta also operates in the areas web & mobile. The firm was founded in the year 2014 by a software engineer, an electrical engineer and a medical instrumentation engineer. In 2016 the company had 5 employees and was in the Seed investment stage. The interview was conducted over Skype.

#### Entrepreneurial orientation characterization

Beta can be described as a quite proactive start-up. With an proactiveness value of 6.0 it is above the average proactiveness score (5.7) of all cases. The innovativeness score 2.0 indicates that the start-up can be seen as a quite innovative start-up. The score is lower than the average innovation score of 2.4. That means that the start-up has a stronger emphasis on innovation than other start-ups in the sample. Beta is a strongly competitive aggressive start-up with a competitive aggressiveness score of 1.5. The average score of 3.2 shows that Beta is the most competitive aggressive firm of all cases. In terms of risk-taking, Beta can be described as a firm with a strong proclivity for high-risk projects. The risk-taking value of 1.3 is the lowest value of all firms in the sample, which had an average score of 2.7. That shows that other start-ups in the sample tend to take less risks. The entrepreneur explains: *“We had significant changes in our product and we risk a lot because I’m presenting our technology to all the manufacturers.”* Furthermore, has Beta a score of 2.0 for autonomy. The average value is 2.6. Beta is a firm that is quite supportive in terms of autonomous work of individuals. *“We give them freedom and we want that they are autonomous with the development of the tasks, but they need to fulfill the roadmap, and the roadmap is always changing.”*

Figure 8 illustrates the entrepreneurial orientation of Start-up Beta.

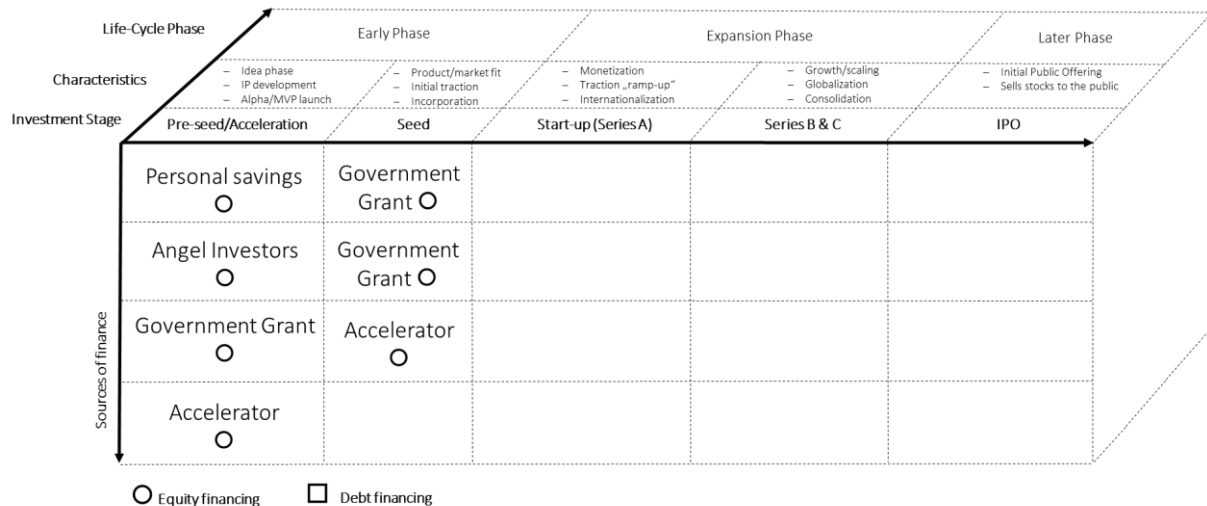


**Figure 8:** Entrepreneurial orientation characterization Start-up Beta

### Sources of financing

Beta started with the personal savings of the founders and an angel investor in the pre-seed/acceleration investment stage. Moreover, the company received a government grant (entrepreneurial internship) and financial support from an accelerator ([Start-up Chile](#)). In the next phase, the firm utilized two government grants ([Portugal 2020](#) and [Desafios Porto](#)). In addition, the start-up was able to obtain money from another accelerator ([Rockstart](#)).

Figure 9 shows an overview of the sources of financing that were obtained by Start-up Beta.



**Figure 9:** Overview of the Sources of financing of Start-up Beta

*“You need money to develop your technology. All sources of financing were incredibly good to put employees to work on the development of our technology”,* says the CEO of Start-up Beta. The entrepreneur thinks that it is important to spend the obtained money wisely, especially on skilled people and networking events. *“Our business angel doesn’t have a network, so the network of Rockstart [Accelerator] was important to get in contact with other companies to increase our knowledge of the market.”* The entrepreneur reckons that government grants such as Portugal 2020 are constrained, because the program is not flexible. *“We have to fulfill what we wrote 2 years ago, although the requirements of our project changed. Portugal 2020 is not flexible.”*

The CEO believes that smart capital does not exist in Portugal for the sector that his start-up is in. *“In our market no one has good contacts to the automotive sector. In Germany or San Francisco exists smart capital, because many people work in this area.”* The founder thinks that Portuguese Venture Capital firms such as Portugal Ventures or Caixa Capital or its incubator UPTEC don’t know a lot about this market, because it’s not a typical market for Portugal.

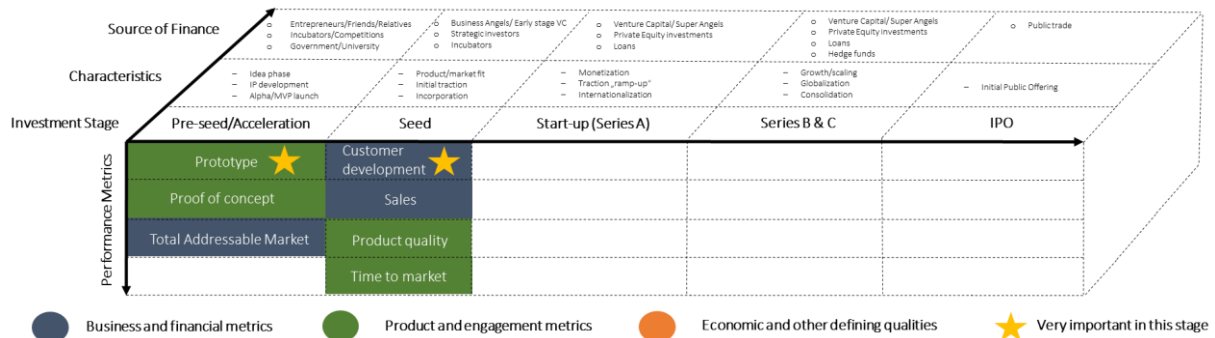
### Performance measurements characterization

Beta was focused on the development of their prototype and proof of concept in the pre-seed stage. *“Accuracy of our technology was the proof that the technology works.”* The metrics in the pre-seed stage were mainly related to the product and the engagement with it. But the company was also looking on the business and financial side - what kind of features the market requires and how big the Total Addressable Market is.

After developing the technology, customer development became the most important metric for the company in the seed stage. *“In the seed stage we had a lot of visits to key companies to understand future trends to develop our road map.”* The Co-founder thinks that *“sales are not that important in that stage, it’s more the partners that are working with you and are giving you feedback. A non-disclosure agreement with BMW is a performance metric.”*

The CEO thinks that his firm should have measured the accuracy of the technology earlier as a proof of concept. *“The investors asked for the data, that was a problem.”*

Figure 10 shows an overview of the performance metrics that were utilized by Start-up Beta.



**Figure 10:** Overview of the performance metrics of Start-up Beta

#### 4.3 Start-up Gamma

*“Survival is the most important metric of all.”*

**CEO and Co-Founder of Start-up Gamma**

##### Background

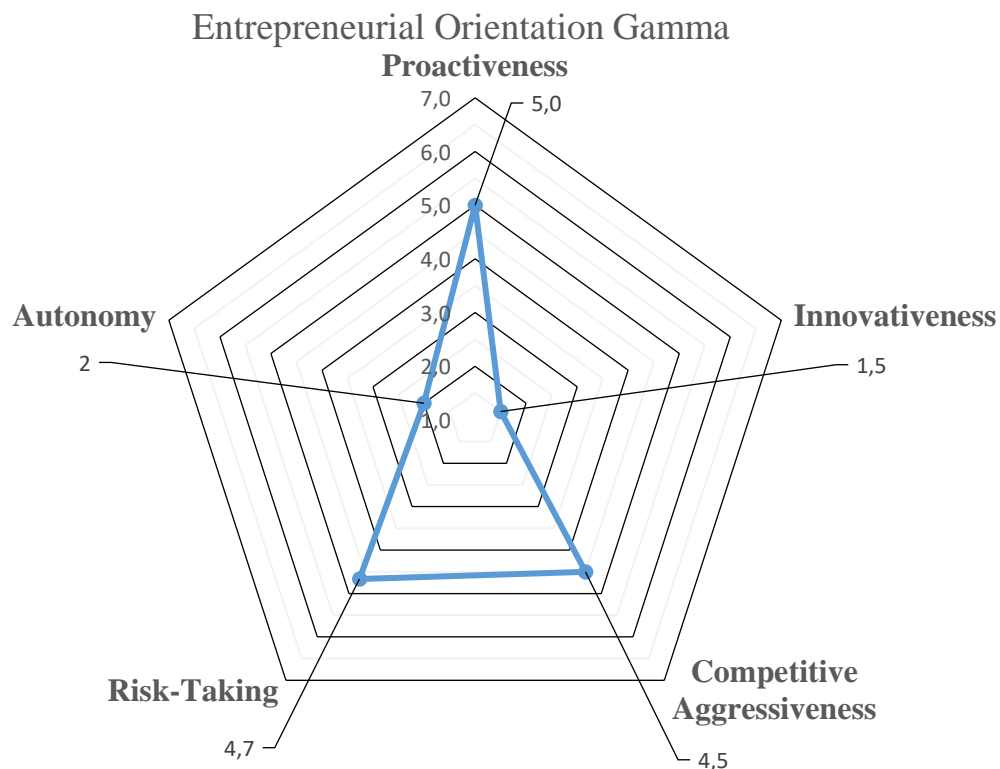
Start-up Gamma is a retail innovation company and develops solutions to improve the customer store experience. The firm operates in the areas mobile, software & retail. The firm was founded in the year 2010. The 3 co-founders have an IT for retail and software engineering background. In 2016 the company had 21 employees and was in the Start-up/Series A investment stage. The interview was conducted in the company’s office in UPTEC in Porto.

##### Entrepreneurial orientation characterization

Gamma can be described as a somewhat proactive start-up. With an proactiveness value of 5.0 it is below the average proactiveness score (5.7) of all cases. The innovativeness score 1.5 indicates that the start-up can be seen as a strongly innovative start-up. The score is together with the score of Zeta the lowest score of the firms in the sample, who had an average innovation score of 2.4. That means that the start-up has a stronger emphasis on innovation than other start-ups in the sample. *“All of our products are completely new and we try, test, evaluate and keep changing the product. My idea is to try to make very small corrections, because we need to be very focused and not follow every trend.”* Gamma has a competitive aggressiveness score of 4.5. The average score of 3.2 shows that Gamma has a lower score, but it does not really give an indication of the degree of competitive aggressiveness. The CEO elucidates: *“We are very aggressive in the sense that we focus on being competitive by differentiation. If you are a start-up, you can change very quickly. Big companies can’t do that, because they are very invested*

*in a product.*” In terms of risk-taking, Gamma can be described as a firm with a tendency to a proclivity for low-risk projects. The risk-taking value of 4.7 is the highest value of all firms in the sample, which had an average score of 2.7. That shows that other start-ups in the sample tend to take more risks. *“I believe that sometimes it is necessary to explore with an incremental behavior, as well as sometimes wide-ranging and bold acts are needed to achieve the firm’s objectives.”* Furthermore, Gamma has a score of 2.0 for autonomy. The average value is 2.6. Gamma is a firm that is quite supportive in terms of autonomous work of individuals. *“I would love if all my employees would work autonomously, but human nature and Portuguese nature loves constantly referring to their supervisors. (...) The reality is that every Portuguese loves a boss. It’s horrible for a manager, because you want autonomy, but people want to be given tasks, although they don’t want to admit that. Then they have all the limits of what we require from them.”*

Figure 11 illustrates the entrepreneurial orientation of Start-up Gamma.

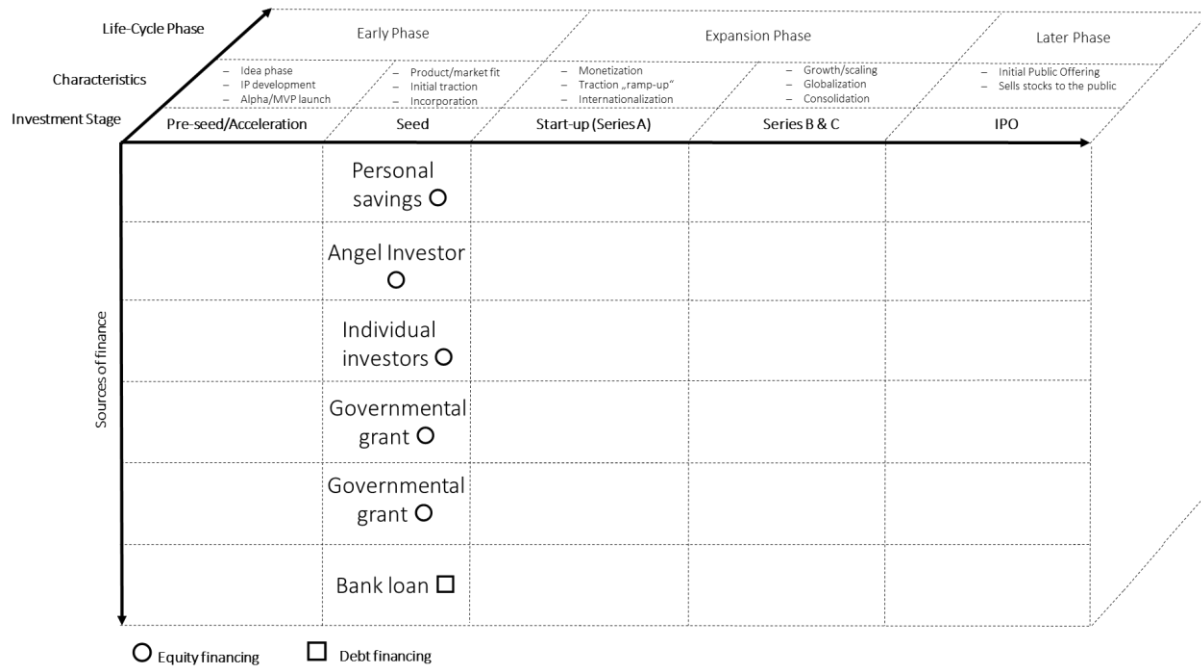


**Figure 11:** Entrepreneurial orientation characterization Start-up Gamma

#### Sources of financing

Start-up Gamma did not have a Pre-seed stage. The company started in the seed investment stage with personal savings of the entrepreneurs. In the same phase, Gamma was able to obtain capital from Angel investors and individual investors, who were no business angels, but treated like them. In the same phase, the firm utilized two government grants (Portugal 2020/ QREN and IEFPP). In addition, the company took out a loan with a bank.

Figure 12 shows an overview of the sources of financing that were obtained by Start-up Gamma.



**Figure 12:** Overview of the Sources of financing of Start-up Gamma

“Business Angels and Venture Capitalists are companies like any other company, but they are selling money”, says the CEO of Start-up Gamma. “There wasn’t really an improvement in performance, so for us the money was only relevant to maintain the operations, to have cash flow, so that we can survive.” The entrepreneur thinks that the situation changes in a later investment stage. “In the Series A investment stage it’s different, you survived until this point and from there on it’s a question of growing. You ask for money to thrive and grow.” In the CEO’s opinion, venture capitalists and business angels are very similar. The angel investors would pass off as closer and more helpful for the entrepreneurs, but at the end they would be exactly the same like venture capitalists. “At the end you will sign a contract with all the details about the return. Subsequently, they invest in a similar company with an add-on to our product, and then they make you do a partnership with them.” Nevertheless, the entrepreneur thinks that business angels could have some positive impact on the performance of a start-up in some cases. According to the co-founder, there was a change in EO after obtaining a bank loan. “Our bank loan gave us time and we were much more prone for risk-taking.” The entrepreneur reckons that government grants such as Portugal 2020 follow a very bureaucratic process. “They don’t want to see the product working, they want to see the invoices properly.” The reason for that is that the grants in the past were used very poorly and therefore the government creates barriers to avoid abuse. Grants from IEFP (Instituto do emprego e formação profissional/Institute for employment and professional development) would “work very well, because it enables us to have more people working here, who were unemployed before. IEFP covers the salaries up to 70%.”

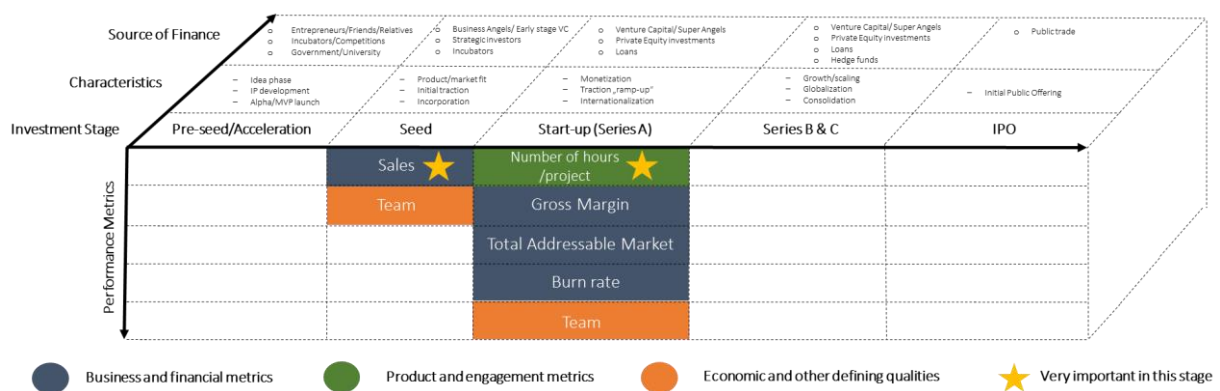
The CEO believes that smart capital is available to a very small extent in Portugal. “Smart capital is having investment from Business Angels or VC’s who can actually create synergies for us.” It is only smart capital if “they are truly invested in you and if they connect and get in touch with other businesses.”

### Performance measurements characterization

Gamma didn't have a pre-seed stage and started in the seed stage with business angels and a product that already had some traction. For the firm it was particularly important to increase their sales. *"The most relevant metric for us was money in the bank and making sure that we were selling more."* The metrics in the seed stage were mainly business and financial metrics but the firm was also measuring other defining qualities such as the team. *"Attrition rate is one thing that we measured, we had 10% attrition, which is good."* In the Start-up investment stage, the number of hours/employee per project became more important, as well as financial metrics such as gross margin, the Total Addressable Market or the burn rate.

The CEO thinks that his firm should have measured more product related metrics in the seed phase. A metric to measure software development productivity would have been important.

Figure 13 shows an overview of the performance metrics that were utilized by Start-up Gamma.



**Figure 13:** Overview of the performance metrics of Start-up Gamma

## 4.4 Start-up Delta

*"VCs and business angels in Portugal are filled with people who have no experience - they are only graduates that just came out of college."*

**CEO and Co-Founder of Start-up Delta**

### Background

Start-up Delta develops a mobile platform where patients can book personal appointments with doctors. The firm operates in the areas web & mobile. The firm was founded in the year 2015 by 6 medical doctors, an engineer and an economist. In 2016 the company had 9 employees. Delta was closing their first investment round and was in the Seed investment stage. The interview was conducted in the company's office in UPTEC MAR in Leça da Palmeira.

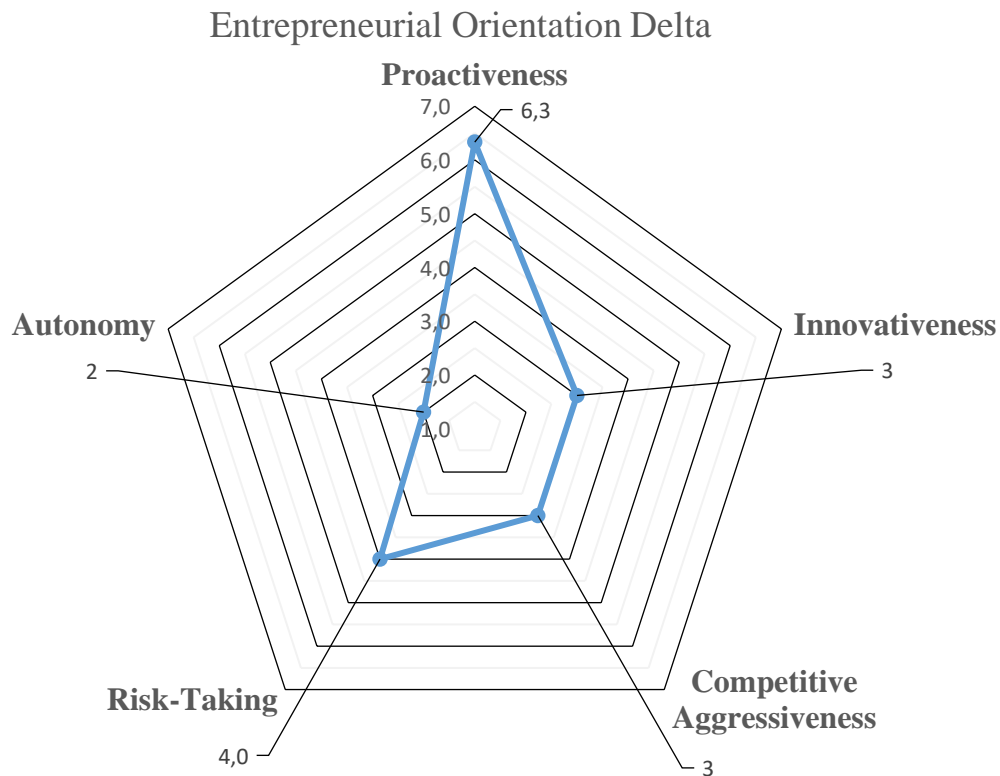
### Entrepreneurial orientation characterization

Delta can be described as a quite proactive start-up. With an proactiveness value of 6.3 it is by far above the average proactiveness score (5.7) of all cases. The proactiveness value is together with Start-up Eta's the highest. Delta tends to be more proactive than other start-ups in the sample. The innovativeness score 3.0 indicates that the start-up can be seen as a somewhat innovative start-up. The score is higher than the average innovation score of 2.4. That means that other start-ups have a stronger emphasis on innovation than Delta. *"Our product is not*

*something that nobody has ever seen before, but it is new for the healthcare area, where we apply it.”* Delta is a somewhat competitive aggressive start-up with a competitive aggressiveness score of 3.0. The average score of 3.2 shows that Delta is the marginally more competitive aggressive as the average firm. *“Insurance companies are the main buyers of house calls, so we’re going to insurances and try to conclude contracts with them. We’re definitely cutting into the business of our competitors.”* In terms of risk-taking, Delta can be described as a firm with a somewhat proclivity for low risk. The risk-taking value of 4.0 is the second highest value of all firms in the sample, which had an average score of 2.7. That shows that other start-ups in the sample tend to take more risks. The entrepreneur explains: *“We are low risk and very conservative in general.”*

Furthermore, has Delta a score of 2.0 for autonomy. The average value is 2.6. Delta is a firm that is quite supportive in terms of autonomous work of the co-founders.

Figure 14 illustrates the entrepreneurial orientation of Start-up Delta.

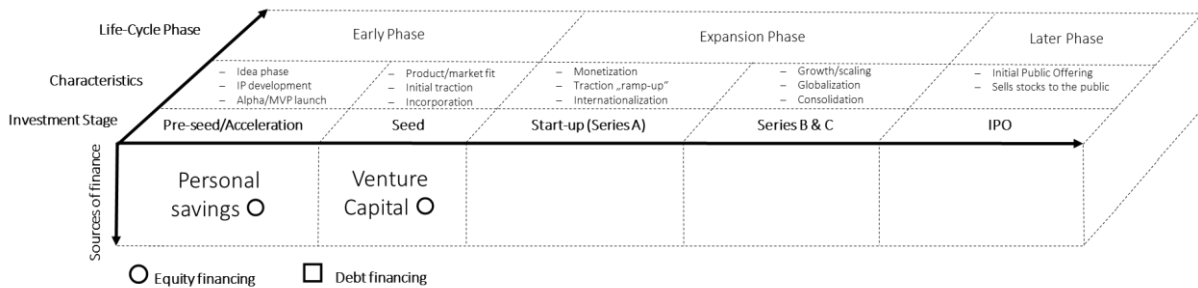


**Figure 14:** Entrepreneurial orientation characterization Start-up Delta



## Sources of financing

Delta started with the personal savings of the entrepreneurs in the Pre-seed/acceleration investment stage. The firm received venture capital in the beginning of the Seed investment stage. Figure 15 shows an overview of the sources of financing that were obtained by Start-up Delta.



**Figure 15:** Overview of the Sources of financing of Start-up Delta

*“I think that we came this far because we did it with our own money”,* says the CEO of Start-up Delta. *“We were able to keep our autonomy to take the decisions we wanted to make to bring the company forward.”* The entrepreneur thinks that requirements related to the source of financing change over the different investment stages. *“Now we want to go international and we’re raising venture capital. Our London based VC has a brilliant network of people across Europe and they are helping us to reach the right people in multiple countries simultaneously.”* In the CEO’s opinion, he wouldn’t be able to reach those people without the backing of the venture capital firm. He also saw an increase in risk propensity after obtaining venture capital. The entrepreneur reckons that the VC was very important for him to challenge him to reflect on his business model and the feedback helped him to become aware of the scalability of his product. *“It’s important to have someone from outside to help you to rethink some processes.”*

The CEO believes that smart capital is very limited in Portugal, because the country doesn’t have a track record of successful VC’s or successful exits. *“In general, the investors in Portugal are not very sophisticated, and if you look at a sector such as ours [health-care], I can honestly say there is no smart capital.”* The founder’s main problem with Portuguese venture capitalists or angel investors is that they would base their feedback on guesses and not on actual facts and experience. *“You ask them to evaluate a business plan, but they have no idea of what they are doing. They aren’t adding any value adding to the discussion. I personally find it incredibly frustrating.”* The entrepreneur regrets starting his company in Portugal. *“We heard all the beautiful things about the Portuguese start-up ecosystem, but if I could go back in time, I would start the company in the Netherlands.”*

## Performance measurements characterization

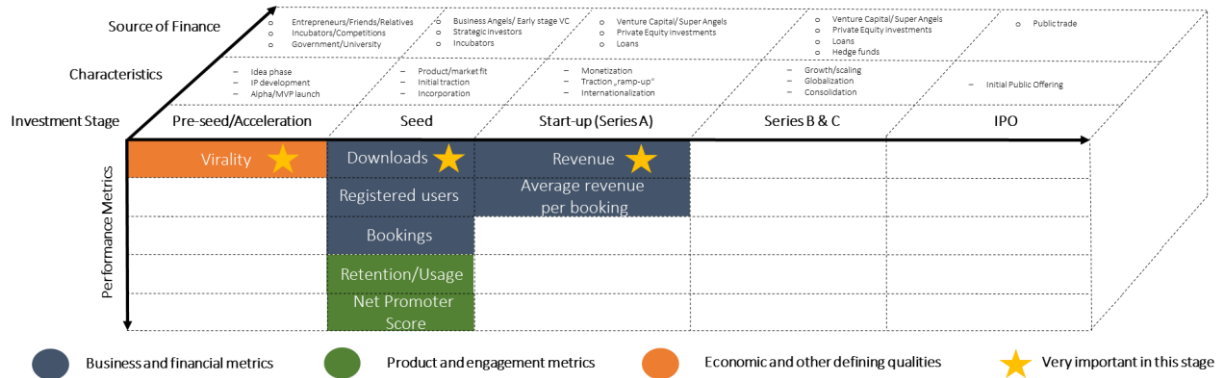
Virality was the most important metric for Delta in the pre-seed phase. *“The number of Facebook likes was very important to validate our concept. That’s how we publicized our company, to see what kind of feedback we would get.”* The metrics in the pre-seed stage were solely related to economic and other defining qualities. After validating that there is a demand for its product and after building it, downloads became the most important metric for the company in the seed stage. It would be also important to track the amount of registered users (both patients and doctors), because that shows a higher involvement than trying the app without registering. Furthermore, the company measured the net promoter score. *“On the*



following day we ask the patient how things went, and we ask how likely it is to recommend the service. All of our appointments have been rated 5 stars.” In the Start-up investment stage, the average revenue per user and the total revenue become more important.

The CEO thinks that his firm should have measured the number of hours that users spend in the app from the beginning.

Figure 16 shows an overview of the performance metrics that were utilized by Start-up Delta.



**Figure 16:** Overview of the performance metrics of Start-up Delta

#### 4.5 Start-up Epsilon

*“Not the money itself made the difference, it was the improved recognition induced by our business angels.”*

**CEO and Co-Founder of Start-up Epsilon**

##### Background

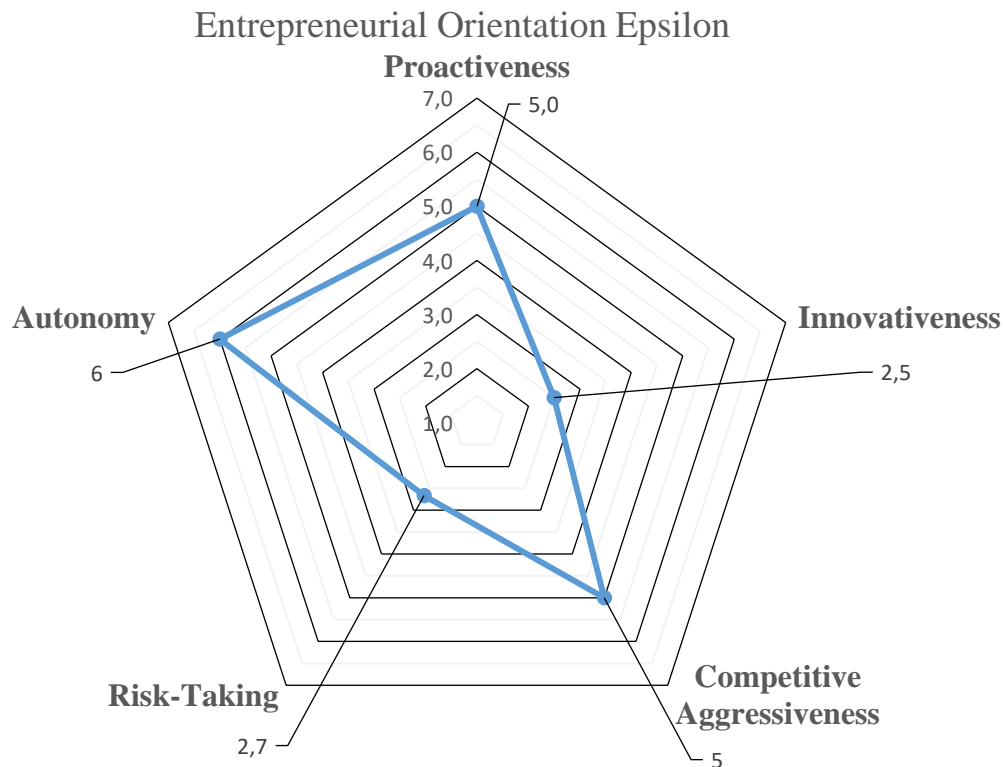
Start-up Epsilon develops a private data management platform to solve digital advertising big data pain points. Epsilon operates in the areas web & ad-tec. The firm was founded in the year 2011 and started as a consultancy company. The two co-founders have a business/product and an engineering background. In 2016 the company had 10 employees and was between the Seed and the Start-up investment stage. The interview was conducted in the company’s office at Founders Founders in Porto.

##### Entrepreneurial orientation characterization

Epsilon can be described as a somewhat proactive start-up. With an proactiveness value of 5.0 it is far below the average proactiveness score (5.7) and less proactive as other companies in the sample. The innovativeness score 2.5 indicates that the start-up can be seen as a quite innovative start-up. The score is higher than the average innovation score of 2.4. That means that the start-up has a marginally weaker emphasis on innovation than other start-ups in the sample. Epsilon is a somewhat not competitive aggressive start-up with a competitive aggressiveness score of 5.0. The average score of 3.2 shows that Beta is the least competitive aggressive firm of all cases. *“Part of our strategy is to go into the market where no one has an offering and you could see that as an aggressive strategy. However, we are not aggressive if you consider all the alternatives on the market.”*

In terms of risk-taking, Epsilon can be described as a firm with a strong proclivity for high-risk projects. The risk-taking value of 2.7 shows somewhat proclivity for high risk projects. The average risk-taking score was 2.7 as well. Furthermore, has Epsilon a score of 6.0 for autonomy. The average value is 2.6. Epsilon has the lowest autonomy score of all companies in the sample, which indicates that the Epsilon is quite not supportive regarding autonomous work. *“In general, we only allow our sales team to work autonomous, in all other business situations we don’t encourage autonomous work.”*

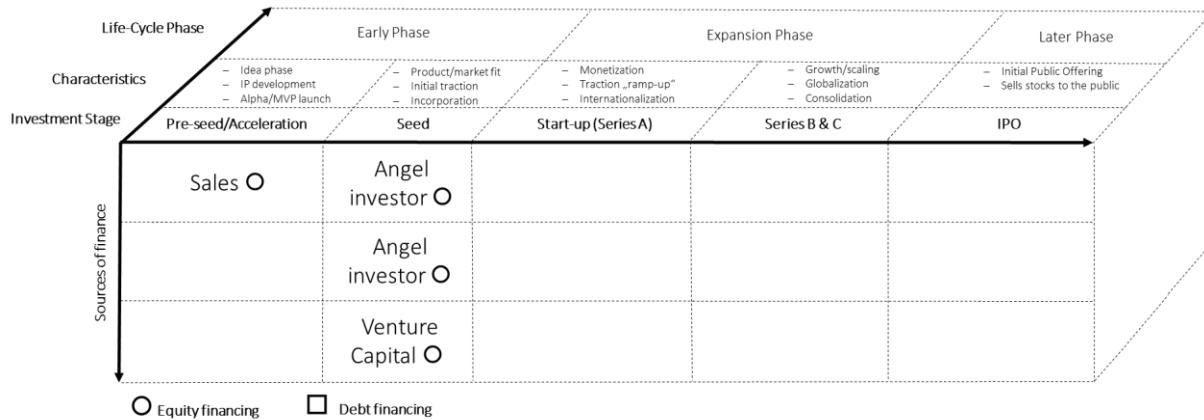
Figure 17 illustrates the entrepreneurial orientation of Start-up Epsilon.



**Figure 17:** Entrepreneurial orientation characterization Start-up Epsilon

#### Sources of financing

Epsilon started without external financing in the Pre-seed/acceleration stage. The firm utilized income from consulting activities as a source of capital. Furthermore, the start-up was able to obtain venture capital and investment from two business angels. The two business angels invested in the same round as the venture capital firm. Figure 18 shows an overview of the sources of financing that were obtained by Start-up Epsilon.



**Figure 18:** Overview of the sources of financing of Start-up Epsilon

“*Venture Capital had a psychological impact*”, says the CEO of Start-up Epsilon. Being venture-capital-backed would help the start-up in the branding/marketing perspectives. “*Potential customers see the names of the venture capitalist and the business angels and it makes them feel safer, because there is someone externally validating the business and someone people know and trust.*” The co-founder adds that they wanted to be riskier and that it was the main reason for trying to obtain venture capital. Moreover, the entrepreneur thinks that an important factor in the purchase decision making is trust in the company and if the start-up will survive.

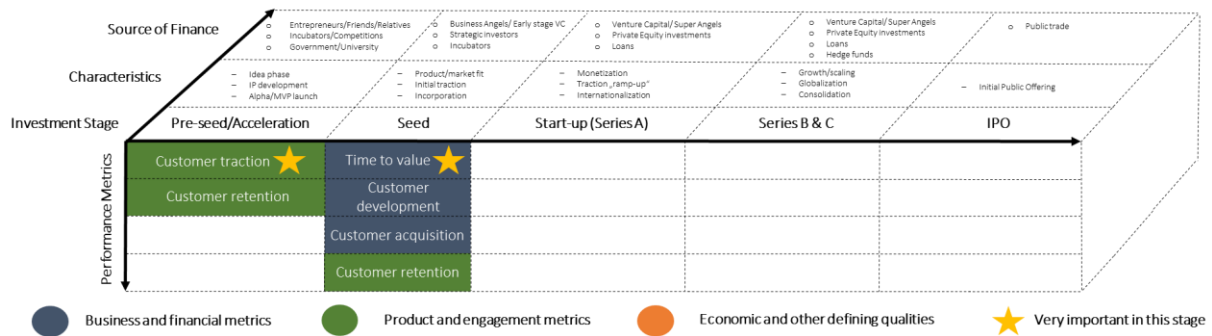
The CEO believes that smart capital in Portugal exists, but it depends on the industry. “*Our industry ad-tec is not a big industry in Portugal. I’m sure that if you go in the more traditional industries you’ll find smart money.*” The two angel investors of Epsilon are from Germany and the United Kingdom. “*Our business angels are exactly what I expect from smart capital.*”

#### Performance measurements characterization

The most important metrics for Epsilon were related to customer traction and customer acquisition. Having an enterprise business model, it was crucial for the firm to acquire enterprise clients. “*We are an enterprise company, so we don’t need hundreds of downloads. We are highly profitable, if we sign 3 large customers.*” The metrics in the Pre-seed stage were mainly related to the product and the engagement of possible enterprise clients with it. After validating that there is a market fit for its product, time to value became the most important metric for the company in the Seed stage. It is very important for the company to reduce the time until a new customer gets acquired. “*We measure that with being very disciplined in our customer relationship management. We are logging everything we can: E-Mails, phone calls etc., so that we have a clear map of the inbound and outbound communication with a potential customer.*”

The CEO thinks that his firm should have measured the time to value sooner, in order to evaluate the real market potential of its product. There would be a direct correlation between time to value and the market size. “*If there is a lot of people that quickly close a deal that gives you a hint that the market is ready and mature enough.*”

Figure 19 shows an overview of the performance metrics that were utilized by Start-up Epsilon.



**Figure 19:** Overview of the performance metrics of Start-up Epsilon

#### 4.6 Start-up Zeta

*“Venture Capital it is a suitable source of financing for the spirit of a high-tech start-up.”*

**CEO and Co-Founder of Start-up Zeta**

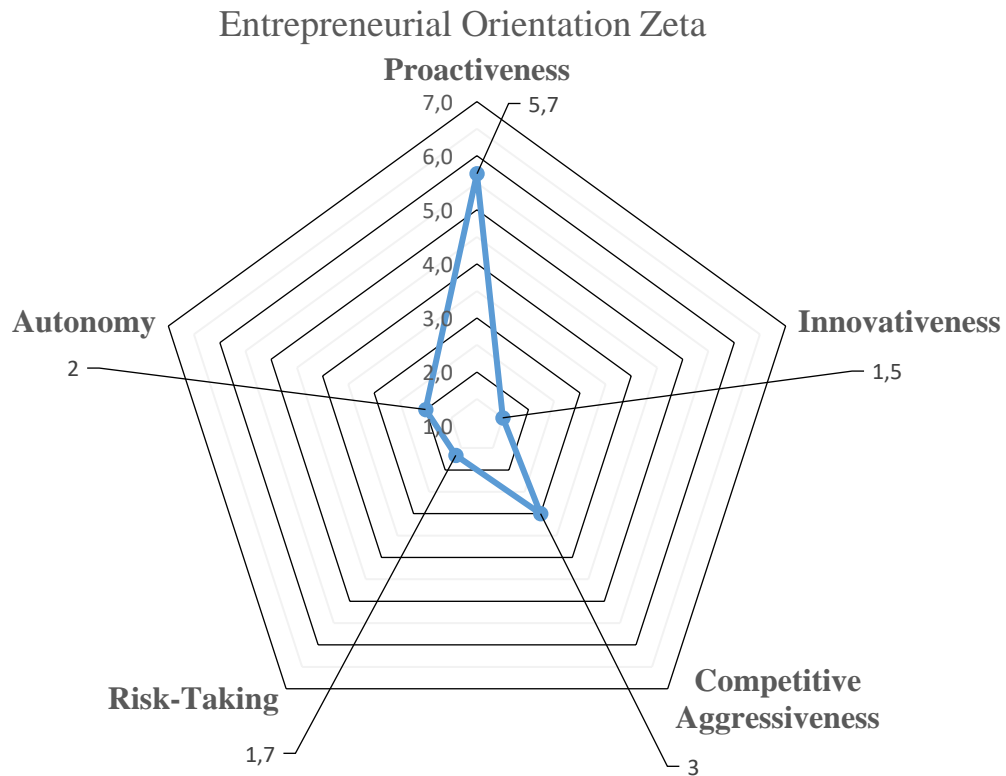
##### Background

Start-up Zeta develops solutions to improve wireless communication to and from mobile devices. Zeta operates in the software area. The firm was founded in the year 2012 by an electrical engineer, a computer engineer and a mathematician. The company started with video-streaming over Wi-Fi, but found a new application for the same platform. The firm focuses now on speeding up file transfer to and from mobile devices, but still offers the first product. In 2016 the company had 10 employees and was in the Start-up/Series A investment stage. The interview was conducted in the company's office in UPTEC in Porto.

##### Entrepreneurial orientation characterization

Zeta can be described as a quite proactive start-up. With an proactiveness value of 5.7 it is on a par with the average proactiveness score (5.7) of all cases. The innovativeness score 1.5 indicates that the start-up can be seen as a strongly innovative start-up. The score is lowest score together with Gamma in the sample. The average innovation score is 2.4. That means that the start-up has a stronger emphasis on innovation than other start-ups in the sample. Zeta is a somewhat competitive aggressive start-up with a competitive aggressiveness score of 3.0. The average score of 3.2 shows that Zeta is marginally more competitive aggressive than the average company in the sample. The entrepreneur explains: *“We are not aggressive by selling cheaper or trying to steal deals but we are competitive aggressive in the sense that we tried to find a different way to get into the market.”* In terms of risk-taking, Zeta can be described as a firm with a quite high proclivity for high risk. The risk-taking value of 1.7 is significantly lower than the average of 2.7. That shows that other start-ups in the sample tend to take less risks. Furthermore, has Zeta a score of 2.0 for autonomy. The average value is 2.6. Zeta is a firm that is quite supportive in terms of autonomous work of individuals. *“Typically, we require our developers to work autonomous, and in the end there is the higher level perspective, if we are moving in the right direction.”*

Figure 20 illustrates the entrepreneurial orientation of Start-up Zeta.

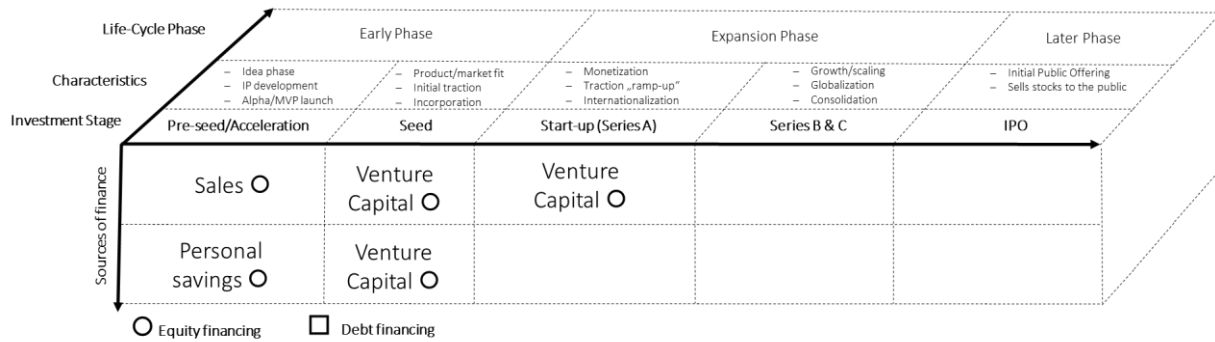


**Figure 20:** Entrepreneurial orientation characterization Start-up Zeta

#### Sources of financing

Zeta started with the personal savings of the entrepreneurs in the Pre-seed/acceleration investment stage. The firm utilized also income from consultancy activities as a source of financing. In the Seed investment stage, the start-up was able to obtain venture capital from two Portuguese VC's. The firm received tax reliefs in the same stage, but it was described as not significant by the entrepreneur. In July 2016 Zeta was raising a bridge that allows the start-up to get to the Start-up (Series A) investment stage.

Figure 21 shows an overview of the sources of financing that were obtained by Start-up Zeta.



**Figure 21:** Overview of the Sources of financing of Start-up Zeta

“We didn’t receive any government grants, because they require you to commit to keep key components of the team”, says the CEO of Start-up Zeta. “But in a start-up you could be doing something completely different in 6 months from now, so I think it does not fit the needs of a start-up.” The entrepreneur thinks that venture capital can be a form of smart money. “VC’s add not only cash but also expertise and networking. Our main investor organized a lot of meet-ups with people in San Francisco, London and Berlin.” Venture capital would have sped up the work in the company but it didn’t change the proclivity for taking risks.

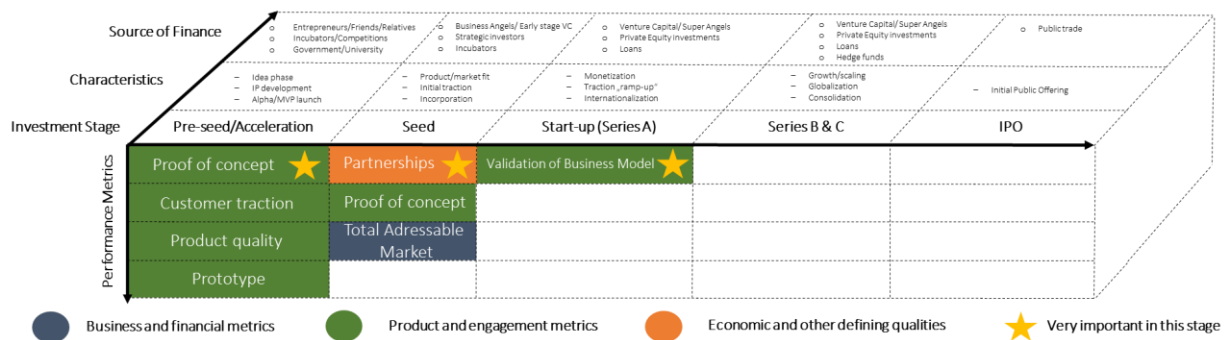
The CEO believes that smart capital is still small in Portugal. “From what I see and hear from other entrepreneurs in the community is our lead investor Portugal Ventures the only one that does this kind of networking and mentoring activities.” Despite the benefits that the VC brings to the table, the founder thinks that the venture capital firm is still inexperienced and in a learning process.

#### Performance measurements characterization

After Zeta pivoted to another product, it was particularly important to validate the technology in the Pre-seed stage. The company built a minimum viable product/prototype and focused on creating a solid product. The firm also tried to create some customer traction and feedback from potential customers. The metrics in the Pre-seed stage were solely related to the product and the engagement with it. After validating that there is a demand for its product and obtaining over 1-million-euro seed funding, other metrics became more important for the company in the Seed stage. “Technical validation was still very important, but partnerships became more important.” In the Start-up investment stage, the main challenge was to validate the business model. “We needed to understand if we are a B2B2C or a B2B2B and to understand the tradeoff of choosing between those business models.”

The CEO thinks that he should have had a better insight in the customer requirements for his firm’s first product. The companies didn’t want a cheap product but a product that fulfills all their requirements. “We were doing everything for free, to speed up the acquisition process, but we ended up losing customer traction, because it was free.”

Figure 22 shows an overview of the performance metrics that were utilized by Start-up Zeta.



**Figure 22:** Overview of performance metrics of Start-up Zeta

#### 4.7 Start-up Eta

*“The more money you have, the better people you can hire and the faster you grow.”*

**CEO and Co-Founder of Start-up Eta**

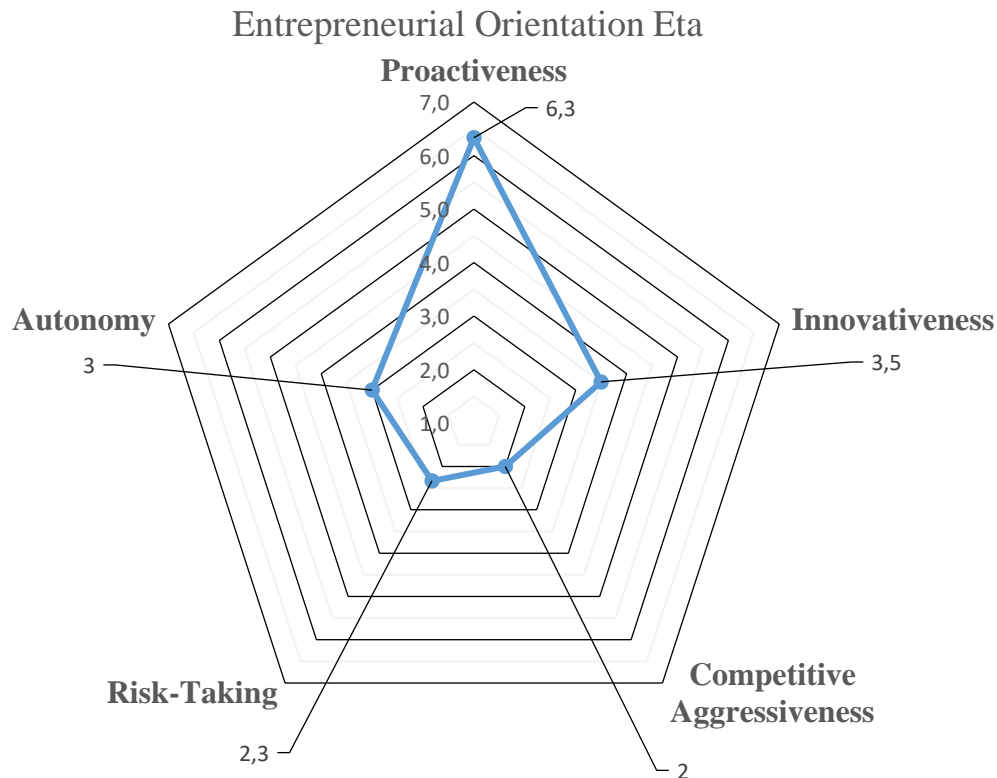
##### Background

Start-up Eta develops distributed monitoring systems for agriculture. The company operates in the web, mobile & software area. The firm was founded in the year 2014 by five electrical engineers. In 2016 the company had 10 employees and was in the Start-up/Series A investment stage. The interview was conducted in the company's office in UPTEC in Porto.

##### Entrepreneurial orientation characterization

Eta can be described as a quite proactive start-up. With an proactiveness value of 6.3 it is above the average proactiveness score (5.7) of all cases. The innovativeness score 3.5 indicates that the start-up can be seen as a somewhat innovative start-up. The score is higher than the average innovation score of 2.4. That means that the start-up has a weaker emphasis on innovation than other start-ups in the sample. The entrepreneur explains: *“Usually, we go to the market, we get feedback and then we analyze and implement it.”* Eta is a quite competitive aggressive start-up with a competitive aggressiveness score of 2.0. The average score of 3.2 shows that Eta is significantly more competitive aggressive than other firms in the sample. In terms of risk-taking, Eta can be described as a firm with a quite high proclivity for high risk projects. The risk-taking value of 2.3 is the lower than average value of all firms in the sample (2.7). That shows that other start-ups in the sample tend to take less risks. Furthermore, has Eta a score of 3.0 for autonomy. The average value is 2.6. Eta is a firm that is somewhat supportive regarding autonomous work of individuals.

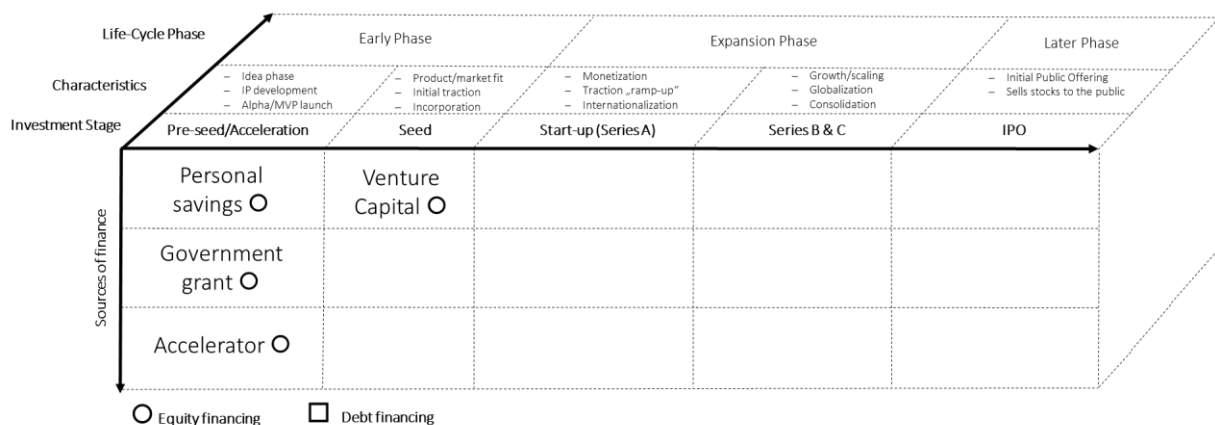
Figure 23 illustrates the entrepreneurial orientation of Start-up Eta.



**Figure 23:** Entrepreneurial orientation characterization Start-up Eta

#### Sources of financing

Eta started with personal savings of the entrepreneurs in the Pre-seed/acceleration investment stage. The firm won a competition for a government grant (+I+E) and was able to get accepted by an accelerator (Start-up Chile). The firm received venture capital in the beginning of the Seed stage. Figure 24 shows an overview of the sources of financing that were obtained by Start-up Eta.



**Figure 24:** Overview of the Sources of financing of Start-up Eta

“*Venture Capital had the most impact on our performance*”, says the CEO of Start-up Eta. “*The most valuable asset that a company has are the people, because they are the ones that are going to create everything from zero.*” The entrepreneur thinks that the more capital the start-up is able to obtain the better people he can hire. “*That’s the reason why I think that venture capital*



is the most important source of financing that we have.” Moreover, venture capital allowed the firm to buy equipment to be able to work faster and to go on business trips for client acquisition.

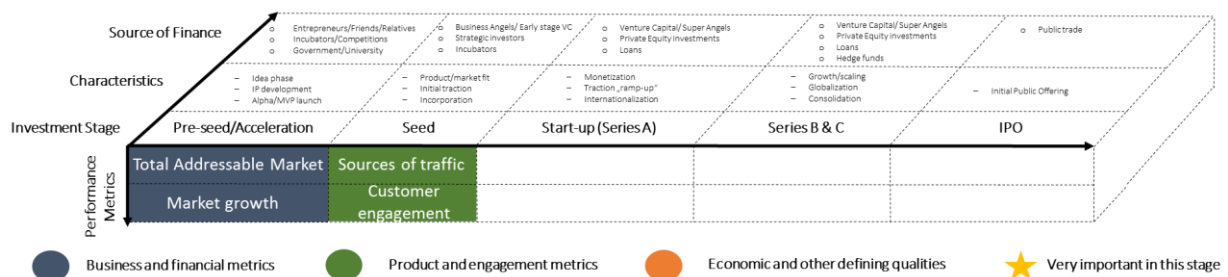
The CEO believes that smart capital is hard to find in Portugal, but it would depend on the market. *“There are very experienced people on some specific markets, we are in the precision agricultural sector, a sector that didn’t exist 5 years ago.”* The founder thinks that there are people who have the knowledge but they wouldn’t have enough money to invest in a start-up. *“Then you have VC’s with money, but they don’t have the knowledge about our sector.”*

#### Performance measurements characterization

The company measured the Total Addressable Market since the very beginning. The firm tried to estimate the total available market in Portugal and the global value of its sector precision agriculture. The metrics in the Pre-seed stage were solely related to the business side. After raising seed-capital, sources of traffic and customer engagement metrics became more important. The firm is measuring where the visitors on the website are coming from, where the users click and how much time they spend on the website. *“We use Google Analytics to gather as much information as possible about the visitors of our website and we monitor everything that is related with the interaction of our system.”*

The CEO thinks that his firm should have measured engagement metrics from the beginning. *“We should have monitored what kind of people are coming to us from where and from where they know us from. That would have been great to characterize the customer better. We just started to do that last month.”*

Figure 25 shows an overview of the performance metrics that were utilized by Start-up Eta.



**Figure 25:** Overview of the performance metrics of Start-up Eta

#### 4.8 Start-up characteristics

The oldest company was founded in 2007 and the youngest in 2015. The median of the start-ups year of foundation is 2012. Start-up Alpha had with 70 employees by far the most employees of all firms in the sample. Beta had with only 5 the fewest number of employees. The average number of employees of the start-ups is 19. Epsilon had only 2 co-founders, which is the least amount, whereas Delta had 8, the highest amount in the sample. The average amount of co-founders is 4 (rounded up). All seven companies had start-up co-founders with engineering backgrounds. Only one co-founder of all firms had a business background.

Table 6 shows an overview of the different characteristics of the start-ups in the sample.

	Start-up Alpha	Start-up Beta	Start-up Gamma	Start-up Delta	Start-up Epsilon	Start-up Zeta	Start-up Eta
<b>Product</b>	Digital marketing platform	Biometrical software	Retail software	Healthcare app	Data management platform	Wireless communication software	Precision agriculture software
<b>Foundation</b>	2007	2014	2010	2015	2011	2012	2014
<b>Area</b>	Web & Mobile	Web, Mobile & Software	Mobile, Software & Retail	Web & Mobile	Web & Ad Tec	Software	Web, mobile & Software
<b>Founders</b>	3	3	3	8	2	3	5
<b>Background of the founders</b>	2 Software engineers, 1 Industrial engineer	Software engineer, Electrical engineer, Medical instrumentation	Retail, IT for retail, Software engineer	Economics, Engineering, 6 medical doctors	Ad Tec, Computer Engineering	Electrical engineering, computer engineering, math	5 Electrical engineers
<b>Employees</b>	70	5	21	9	10	10	10
<b>Interview with</b>	CEO & Co-Founder	CEO & Co-Founder	Joint CEO & Co-Founder	CEO & Co-Founder	CEO & Co-Founder	CEO & Co-Founder	CEO & Co-Founder

**Table 6:** Overview Start-up Characteristics

## 5 Conclusions

*In this chapter, the findings of each start-up are discussed and the research questions are answered. Ultimately, the limitations of the research are explained and the outlook for further research is described.*

### 5.1 Results and discussion

Sources of financing of web, mobile and software start-ups in UPTEC

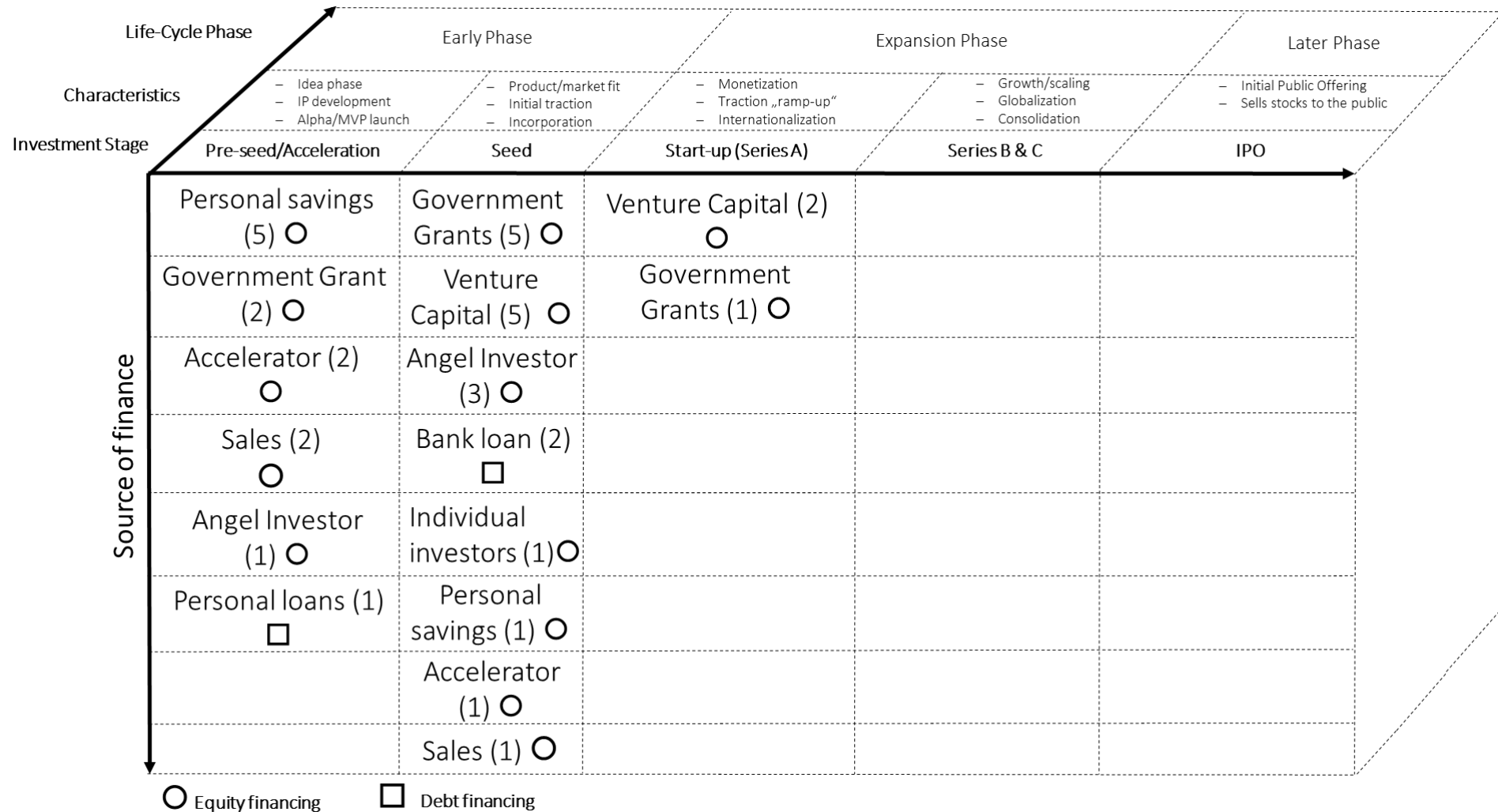
The most frequent source of financing in the Pre-seed/acceleration phase was personal savings. Five out of 7 companies used their own money to start their business. Two companies used government grants such as the “Entrepreneurial Internship” and “+I+E”. Furthermore, two firms were able to obtain capital from the Accelerator “Start-up Chile”. The two companies that didn’t use their personal savings in the pre-seed phase had a consultancy project and used the income from this project to fund their company. Therefore, the capital was not generated from the core business or an eventual minimum viable product and is very atypical for the Pre-seed stage. One firm was invested by an angel investor in the Pre-seed stage. Another firm took out personal loans from the co-founders.

The most common sources of financing in the Seed stage are governmental grants and venture capital. Mainly the governmental grants came from the programme Portugal 2020. The programme brings together 5 structural European investment funds with an overall investment of 25 billion euros between 2014 and 2020 to stimulate growth and create jobs in Portugal (Portugal 2020, 2016). In general, the entrepreneurs were not fond of the programme, because it is not flexible and very bureaucratic. Five firms obtained venture capital in the Seed stage, mostly investments by the Portuguese VC Portugal Ventures. Three start-ups had angel investors from Portugal, United Kingdom and Germany and one firm had an individual investor, who as treated like a business angel. Furthermore, two firms took out a bank loan, and one firm each utilized personal savings, sales and accelerator.

In the Start-up stage was venture capital the most used source of financing. Two start-ups raised a Series A round. One start-up received another governmental grant.

The findings validate that venture capital and business angel capital are seen as one of the most important sources of financing in entrepreneurship literature. It is noteworthy that the equity financing was dominant in each phase and that debt financing rarely plays a decisive role in the mind of the entrepreneurs. The majority of the entrepreneurs thinks that smart capital exists to a limited extent in Portugal. For traditional established industries there could be smart capital, for unusual and more specific industries however not.

Figure 27 displays the source of financing framework applied to web, mobile & software start-ups incubated in UPTEC. In brackets after every source of financing is the number of start-ups which used that particular source of financing.



**Figure 26:** Sources of financing framework applied to start-ups in UPTEC

The most important performance metrics in the Pre-seed/acceleration phase were proof of concept, the prototype and customer traction. The performance metric in this stage are mainly related with the product and engagement. Other metrics in this stage were customer retention, a minimum viable product and product quality. Some firms used also business and financial metrics in this phase, but those metrics were solely related to the market. The companies tried to measure the Total Addressable Market and the market growth in the sector. Furthermore, one company also tried to measure the virality of its product, the only metric from another defining quality. The main goal in the phase for the entrepreneurs was to develop and validate their technologies, which is reflected by the metrics in this stage.

The type of performance measurements changed in the Seed stage. Business and financial metrics became more important. The entrepreneurs pointed out sales, customer acquisition and time to value as most significant metrics in this stage. Most of the companies had a product with initial traction at this point. The firms started to measure registered users, bookings, downloads of their apps or platforms. Customer development and customer value as well as the Total Addressable Market were further business metrics in this stage. The companies also measured product and engagement metrics such as retention/usage of their platforms, product quality, customer engagement, proof of concept, time to market and the sources of traffic on the website. Economic and other defining qualities also have gained a growing importance in this stage. For one entrepreneur was partnerships the most crucial metric in this investment stage, because his company had an enterprise facing business model. The team and net promoter score are more metrics that have been measured in this phase. The main goal in the phase for the entrepreneurs was to create initial traction for their products, which is mirrored by the metrics related to customer development in this stage.

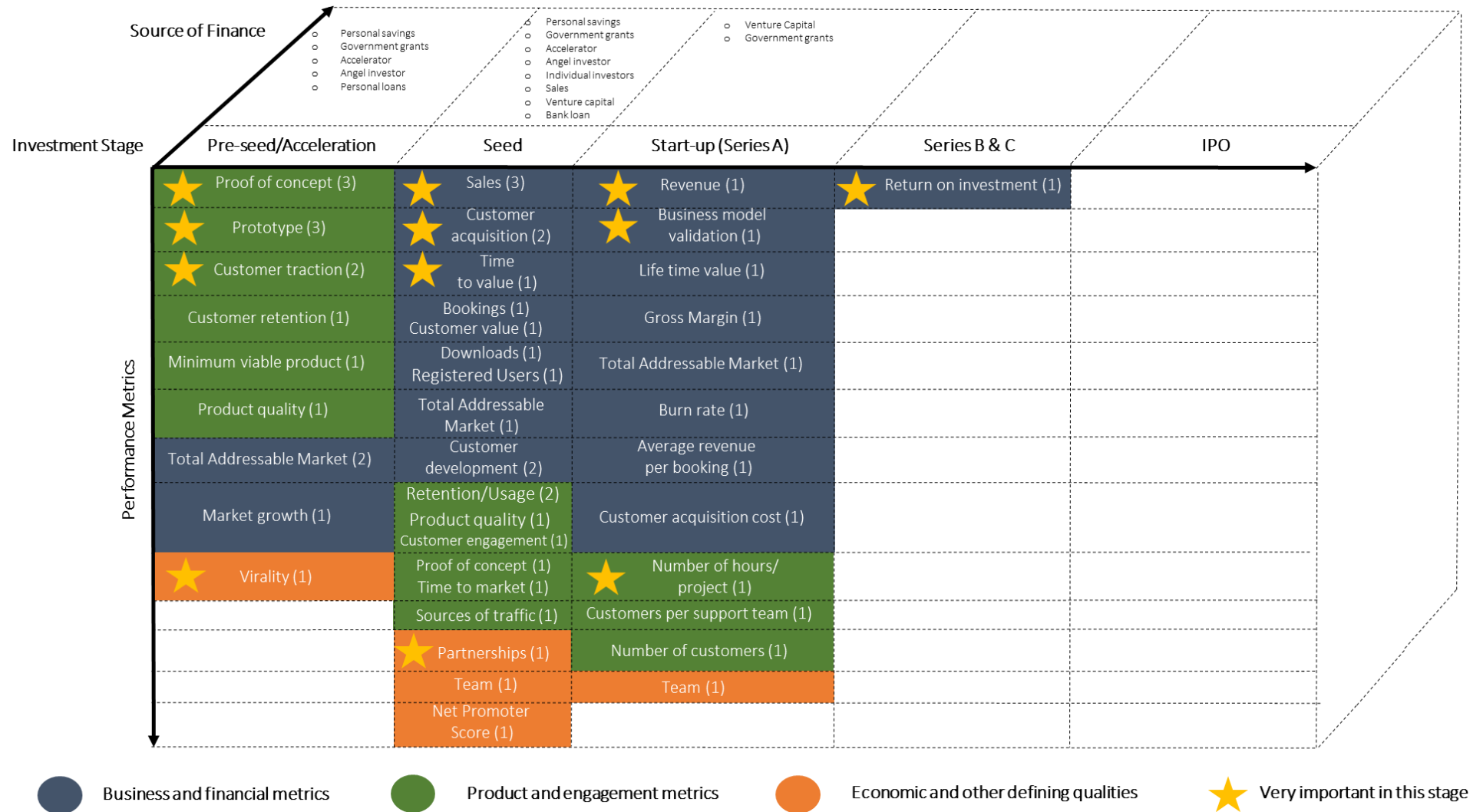
In the Start-up stage business and financial metrics were clearly the most important metrics. Classical business metrics such as revenue, average revenue per booking, gross margin or burn rate shifted to the foreground. Metrics that can be found in prevalent performance literature. For one entrepreneur was business model validation the most important metric, a process that happens after the product was successfully validated. Life-time value, customer acquisition cost and the Total Addressable Market were measured as well. The importance of product/engagement metrics started to decrease. However, the number of hours/project, customers/support team or number of customers were important.

Only one company reached the Series B investment stage. The company started to measure return on investment in this later phase.

The CEOs of the start-ups think that they should have measured the following metrics earlier:

- More product related metrics in the Seed phase
- Customer engagement metrics from the beginning
- Number of hours users spend in the app
- Time to value
- Accuracy of the technology as a proof of concept
- Return of investment as soon as sufficient data is available

Figure 28 illustrates the performance framework applied to web, mobile & software start-ups incubated in UPTEC. In brackets after every performance metric is the number of start-ups which used that particular metric in that stage. In addition, the most important performance metrics pointed out by the entrepreneurs are highlighted with a star.



**Figure 27:** Performance framework applied to start-ups in UPTEC

## Relationship between the sources of financing and their impact on the performance of the new venture

For Alpha had their bank loan the most impact on their business because it allowed them to keep the firm under direct control. For the entrepreneur from Start-up Beta was not the type of source of financing important, rather the amount, because the firm could hire skilled people to develop the technology. In the early stages, Gamma didn't experience an improvement in performance due to a particular source of financing. It was just a way to maintain the operations and to survive. However, the situation changed in the expansion phase of the company, because venture capital or angel investments are needed to stimulate the growth of the company. In addition, the bank loan made the company more prone for risk-taking. Delta also wanted to keep its autonomy and used only their personal savings. The entrepreneur also believes that the requirements related to the source of financing change over the different investment stages. In the expansion phase venture capital was essential to understand the scalability of the product. The CEO of start-up Epsilon also believes that venture capital has advantageous impact on performance, especially in customer acquisition and development. Start-up Zeta could speed up their work and increase their network through the venture capitalists. For the co-founder of Start-up Eta had venture capital the most impact on their performance. They were able to hire better people and acquire customers after obtaining venture capital.

Table 7 attempts to formulate a pattern regarding the impact of sources of financing, the demand of the entrepreneurs and the most relevant performance metrics along the different stages.

	Early stage (Pre-seed & Seed)	Expansion stage (Start-up, Series B&C)
Demand of the entrepreneur	Survival and control of the business	Networking, expertise and growth
Most suitable sources of financing	Personal savings, bank loan, personal loan	Venture capital, business angel capital
Most relevant performance metrics	Proof of concept, prototype, customer acquisition, partnerships	Revenue, business model validation, return on investment

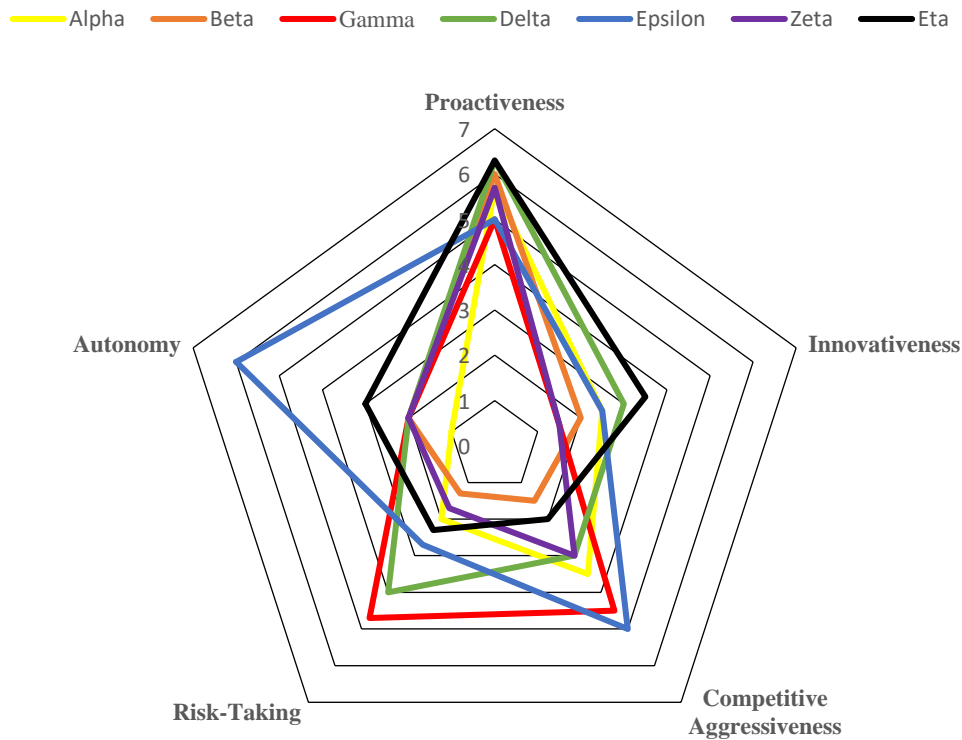
**Table 7:** Relationship between sources of financing and performance

Entrepreneurial orientation of the start-ups in the pursuit of linking the former with sources of financing and performance measurements

In the entrepreneurial orientation were certain commonalities in the degree of the proactiveness dimension. All companies were quite proactive or somewhat proactive. Two of the companies were strongly innovative, three quite innovative and two somewhat innovative. The dimension of competitive aggressiveness and risk taking cover both a broad range. Most of the companies supported autonomous work, only Eta stood out with being quite not supportive regarding autonomous work.



Figure 28 compares the different entrepreneurial orientation dimensions of all start-ups in the sample.



**Figure 28:** Entrepreneurial orientation dimensions compared

Linking the entrepreneurial orientation of the start-ups with the sources of financing was not or only to a very limited extent feasible. For example, two strongly innovative companies (Gamma and Zeta) used completely different sources of financing and had also completely different expectations from the particular source of financing. Another example would be that companies that tend to be less competitive aggressive (Epsilon and Gamma) raise similar sources of financing than companies that are rather competitive aggressive (Beta and Eta). For this reasons, the sources of financing could not be linked with the entrepreneurial orientation.

Linking the entrepreneurial orientation of the start-ups with the performance was more feasible. One noticeable characteristic of a strongly innovative start-up firm (Zeta) is that they tend to have proclivity for product and engagement metrics. In the pre-seed phase, Zeta measured solely product related metrics such as proof of concept, customer traction, product quality and prototype. Strongly competitive aggressive companies such as Beta focused on metrics related to their market. Beta measured the Total Addressable Market, customer development and the time to market. Firms that prefer to take less risk (Gamma and Delta) valued conventional business metrics such as sales, revenue, average revenue per booking, gross margin or burn rate.

Table 8 attempts to formulate a pattern regarding the choice of performance metrics and the entrepreneurial orientation.

<b>Entrepreneurial orientation</b>	<b>Preferred performance metrics</b>
Strongly innovative	Product and engagement metrics
Strongly competitive aggressive	Market related metrics
Proclivity for low risk	Business and financial metrics

**Table 8:** Relationship between entrepreneurial orientation and performance metrics

## 5.2 Limitations and further research

Future research needs to examine how different new sources of financing such as accelerators, crowdfunding or peer-to-peer lending impact new venture performance and how it varies over the different investment stages. Moreover, there is a lack of qualitative research on entrepreneurial orientation and further research should implement better conceptualizations of entrepreneurial orientation in order to evaluate a set of conditions and their effects. It is recommended to repeat the study and to test the findings of this study on companies with varying levels of proactiveness, innovativeness, competitive aggressiveness, risk-taking proclivity and autonomy.

The limitations of the study originate from the theoretical framework and the design of the study. Measuring intangible metrics such as “team” represents a challenge. In-depth interviews help to collect deeper insights in the possibilities to measure intangible key performance indicators. The study is framed in the specific environment in UPTEC in Porto, Portugal. The start-up environments all over the world differ and the findings are not generalizable. One of the limitations of the case study approach is that it can lead to generalization problems of a theoretical nature (Flick, 2009).

In seeking universality, the business model of the start-ups has to be differentiated. Especially the type of organization and who the companies create value for (B2B/B2C/Enterprise) (Morris, Schindehutte and Allen, 2005) has to be taken into consideration. The performance metrics as well as the requirements to the sources of financing differ considerably depending on the respective business model. Therefore, a series of case studies in different start-up environments and different business models should be conducted. These findings might give insight in the universality of the research.

A performance framework that considers the industry, environment as well as the business model of the companies can display the most relevant performance metrics and sources of financing for start-up companies.

The framework may be very useful for entrepreneurs who want to raise venture capital or business angel capital, because investors place high value on performance metrics.

This research represents a step in that direction.

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## Appendix

### Appendix 1: Entrepreneurial orientation questionnaire

#### Proactiveness

In dealing with its competitors, my firm ...		
Typically responds to action which competitors initiate	①   ②   ③   ④   ⑤   ⑥   ⑦	Typically initiates actions which competitors then respond to
Is very seldom the first business to introduce new products/services, administrative techniques, operating technologies, etc.	①   ②   ③   ④   ⑤   ⑥   ⑦	Is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc.

In general, the top employees of my firm have ...

A strong tendency to “follow the leader” in introducing new products or ideas	①   ②   ③   ④   ⑤   ⑥   ⑦	A strong tendency to be ahead of other competitors in introducing novel ideas or products
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#### Innovativeness

In general, the top employees of my firm favour...		
A strong emphasis on R&D, technological leadership, and innovations	①   ②   ③   ④   ⑤   ⑥   ⑦	A strong emphasis on the marketing of tried-and-true products or services
In the past 5 years...		

Changes in product or service lines have usually been quite dramatic.	① ② ③ ④ ⑤ ⑥ ⑦	Changes in product or services lines have been mostly of minor nature

### Competitive Aggressiveness

My firm is very aggressive and intensely competitive.	① ② ③ ④ ⑤ ⑥ ⑦	My firm makes no special effort to take business from the competition
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In dealing with its competitors, my firm ...

My firm typically adopts a very competitive “undo-the-competitors” posture.	① ② ③ ④ ⑤ ⑥ ⑦	Typically seeks to avoid competitive clashes, preferring a “live-and-let-live” posture
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### Risk-Taking

In general, the Administration of my firm has ...		
A strong proclivity for low-risk projects (normal and certain rates of return)	① ② ③ ④ ⑤ ⑥ ⑦	A strong proclivity for high risk projects (with chances of very high returns).
In general, the top employees of my firm believe that ...		
Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm’s objectives.	① ② ③ ④ ⑤ ⑥ ⑦	Owing to the nature of the environment, it is best to explore it gradually via timid, incremental behaviour.

When confronted with decisions involving uncertainty, my firm ...

Typically adopts a bold posture in order to maximize the probability of exploiting opportunities.	① ② ③ ④ ⑤ ⑥ ⑦	Typically adopts a cautious wait-and-see posture in order to minimize the probability of making costly decisions
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**Autonomy**

My firm supports the efforts of individuals and/or teams that work autonomously.	① ② ③ ④ ⑤ ⑥ ⑦	In my firm, individuals and/or teams have to refer to their supervisor(s)
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**Appendix 2:** Entrepreneurial Orientation Likert Scale itemization

	<b>Proactiveness</b>	<b>Innovativeness</b>	<b>Competitive Aggressiveness</b>	<b>Risk-Taking</b>	<b>Autonomy</b>
<b>1</b>	Strongly passive start-up	Strongly innovative start-up	Strongly competitive aggressive start-up	Strong proclivity for high risk	Strongly supports autonomous work
<b>2</b>	Quite passive start-up	Quite innovative start-up	Quite competitive aggressive start-up	Quite high proclivity for high risk	Quite supportive regarding autonomous work
<b>3</b>	Somewhat passive start-up	Somewhat innovative start-up	Somewhat competitive aggressive start-up	Somewhat proclivity for high risk	Somewhat supportive regarding autonomous work
<b>4</b>	Neither proactive nor passive	Neither innovative nor customary	Neither competitive aggressive nor not competitive aggressive	Neither high risk nor low risk	Neither supportive nor not supportive regarding autonomous work
<b>5</b>	Somewhat proactive start-up	Somewhat customary start-up	Somewhat not competitive aggressive start-up	Somewhat proclivity for low risk	Somewhat not supportive regarding autonomous work
<b>6</b>	Quite proactive start-up	Quite customary start-up	Quite not competitive aggressive start-up	Quite high proclivity for low risk	Quite not supportive regarding autonomous work
<b>7</b>	Strongly proactive start-up	Strongly customary start-up	Strongly not competitive aggressive start-up	Strong proclivity for low risk	Strongly doesn't support autonomous work

**Appendix 3: Interview guideline**

1. **When was your company founded? (year)?**

2. **In which area(s) operates your start-up?**

☐ Web   ☐ Mobile   ☐ Software   ☐ \_\_\_\_\_

3. **Number of employees in 2016:**

4. **What is the background of the 5 founders?**

5. **In what investment stage would you place your company?**

- ☐ **Pre-seed/Acceleration** (Idea phase – IP development – Alpha/MVP launch)
- ☐ **Seed** (Product/market fit – Initial traction – Incorporation)
- ☐ **Start-up/Series A** (Monetization – Traction increase – Internationalization)
- ☐ **Series B & C** (Growth/Scaling – Globalization – Consolidation)
- ☐ **IPO** (Initial Public Offering –Sells stocks to the public)

6. **Performance measurement framework**

7. **We should have measured ...**

8. **Was a performance measurement particularly important in a specific stage? Why?**

9. **Source of financing framework**

10. **Does the source of capital have an advantageous impact on the performance of the venture?**

11. **Were there changes in the entrepreneurial orientation after obtaining a particular Source of financing?**

12. **To what extent does smart capital exist in Portugal?**

**Appendix 4:** Interview consent form**Consent form****Participation in a case study**

I volunteer to participate in the case study “*Sources of financing and performance metrics in early-stage start-ups*” conducted by Florian Rehm from the Faculty of Engineering of the University of Porto and INESC TEC Porto. I understand that the project is designed to gather information about early-stage start-ups incubated in the Science and Technology Park of University of Porto (UPTEC). I will be one of approximately 7 representatives of start-ups being interviewed for this research.

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1. My participation in this project is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time.
2. The interview will last approximately 30-45 minutes. Notes will be taken during the interview. The interview will also be recorded and a subsequent dialogue will be created. If I don't want to be taped, I can let the interviewer know at any time.
3. I understand that the researcher will not identify me or my firm by name in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure (For instance: “Start-up A” instead of “Start-up Name”).
4. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.
5. I have been given a copy of this consent form.

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**Name of the entrepreneur (Start-up name)**

**City, Date**



**Appendix 5:** Entrepreneurial orientation overview

	<b>Start-up Alpha</b>	<b>Start-up Beta</b>	<b>Start-up Gamma</b>	<b>Start-up Delta</b>	<b>Start-up Epsilon</b>	<b>Start-up Zeta</b>	<b>Start-up Eta</b>
<b>Proactiveness</b>	Quite proactive	Quite proactive	Somewhat proactive	Quite proactive	Somewhat proactive	Quite proactive	Quite proactive
<b>Innovativeness</b>	Quite innovative	Quite innovative	Strongly innovative	Somewhat innovative	Quite innovative	Strongly innovative	Somewhat innovative
<b>Competitive Aggressiveness</b>	Somewhat competitive aggressive	Strongly competitive aggressive	Neither competitive aggressive nor not competitive aggressive	Somewhat competitive aggressive	Somewhat not competitive aggressive	Somewhat competitive aggressive	Quite competitive aggressive
<b>Risk-Taking</b>	Quite high proclivity for high risk	Strong proclivity for high risk	Neither high risk nor low risk	Neither high risk nor low risk	Somewhat proclivity for high risk	Quite high proclivity for high risk	Quite high proclivity for high risk
<b>Autonomy</b>	Strongly supports autonomous work	Quite supportive regarding autonomous work	Quite supportive regarding autonomous work	Quite supportive regarding autonomous work	Quite not supportive regarding autonomous work	Quite supportive regarding autonomous work	Somewhat supportive regarding autonomous work

**Appendix 6:** Paper for ISPIM Innovation Conference

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## Financing sources and performance metrics in early-stage start-ups

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**Abstract:** On the one hand, a crucial component of every entrepreneurial firm and its performance is the access and availability to sufficient capital. On the other hand, various scientists from different disciplines have devoted themselves to answer the question of how the performance of a business can be measured. However, little work exists on the relationship between the access to external financing sources and the performance of an early-stage start-up. The most important determinants of performance in the literature are financial performance measures such as sales growth or employee growth. Nevertheless, these metrics are not suitable if applied to an early-stage start-up. This paper aims to present a start-up performance metric framework, that allows to assess start-up performance in the different investment stages. The results show that not only the amount of raised capital is important, but also that particular Sources of financing have an advantageous impact in boosting start-up performance.

**Keywords:** Entrepreneurial finance; start-up performance; entrepreneurial cognition; early-stage start-ups; performance metric framework, investment stage

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## **1 Introduction**

One of the most essential questions of microeconomic entrepreneurship research is how entrepreneurial firms are financed (Cassar, 2004). It is still inconclusive how early-stage investors impact start-ups with their investments (Kerr et al., 2014). On the one hand, a crucial component of every entrepreneurial firm and its performance is the access and availability to sufficient capital (Marlow and Patton, 2005; La Rocca et al., 2011). On the other hand, various scientists from different disciplines have devoted themselves to answer the question of how the performance of a business can be measured (Neely, 1999). Fraser (2015) created an integrated framework relating entrepreneurial finance and a firms’ growth. The authors show that, little work exists on the relationship between the access to external financing sources and the growth of the new venture. Wiklund and Shepherd (2005) note that it is beneficial to integrate various dimensions of performance in empirical research, due to the multidimensionality of performance. Firm growth is used in various studies as indicator for business performance (Brush and Vanderwerf, 1992; Chandler and Hanks, 1993; Fombrun and Wally, 1989; Tsai et al., 1991). However, the growth of a start-up company has different impacts than the growth of established ventures (Gilbert et al., 2006). There is still only little known about small firm growth, mainly because each study focuses only on a fraction of variables of the other studies (Wiklund et. al., 2009).

As a research-in-progress paper submission the results presented in this paper aim at providing an overview of how different performance metrics are applied by start-up firms and their importance on early stage performance regarding the different investment stages. Furthermore, we identify the different Sources of financing according to the literature. The output of this paper, will be used as a framework in a qualitative research study applied to a selection of web, mobile & software academic start-ups, incubated in the Science and Technology Park of the University of Porto (UPTEC) in Portugal. This study aims to describe (i) what Sources of financing web, mobile & software early stage start-ups in UPTEC utilize to counter the lack of finance; (ii) how the performance of a web, mobile & software early stage start-ups in UPTEC can be quantified; and, (iii) if a particular Source of financing has an advantageous impact on the performance of the venture according to the entrepreneur’s point of view.

## **2 Sources of financing**

### *Venture Capital*

Black and Gilson (1998) define venture capital as “investment by specialized venture capital organizations (...) in high-growth, high-risk, often high-technology firms that need capital to finance product development or growth and must, by the nature of their business, obtain this capital largely in the form of equity rather than debt.” Achleitner (2001) defines venture capital as the financing of a privately held company with equity. Furthermore, Achleitner points out that the term ‘venture capital’ is subject to the life cycle phase of the company. Whereas venture capital *sensu stricto* means the financing of new ventures, it is referred to the participation in established companies as ‘private equity investment’. Companies that receive venture capital are generally young and small and exhibit large information asymmetries between investors and entrepreneurs. (Gompers and Lerner, 2001).

### *Business Angel Capital*

Business angel financing is one of the main alternatives to venture capital financing and is also at times described as informal venture capital. (Hellmann and Puri, 2000; Becker-Blease and Sohl, 2015). In various countries business angel capital is the largest source of external funding of start-ups after funding from family and friends (Avdeitchikova et. al., 2008). Business angels provide external financing to new ventures and are therefore essential to entrepreneurs (Ding et al., 2015).

### *Other sources of financing*

Other sources of financing may include, but are not limited to bootstrapping, microfinance, peer-to-peer-lending, government grants, accelerators and crowdfunding.

Financial bootstrapping is a way of meeting the financial demands of a new venture without the use of external debt finance or new shareholders (Winborg and Landström, 2000). Although bootstrapping's prominence and dissemination among entrepreneurs, (Ebben and Johnson, 2006) little literature exists on understanding how bootstrapping impacts the development of a start-up (Ebben and Johnson, 2006). Other Sources of financing such as microfinance can help individuals that do not have access to conventional finance sources (Khavul, 2010). Microfinancing and peer-to-peer landing are new sources of financing a

start-up and so far, only little research has been conducted into the extent of the impact of these new financing instruments (Bruton et. al., 2014). These Sources of financing allow individuals to lend money without a bank as a middleman (Zhang and Liu, 2012). Lately, new ventures can utilize sources of funding such as crowdfunding and accelerators (Fraser et al., 2015). Denis (2004) found that it is necessary to analyse alternative Sources of financing such as corporate financing to comprehend what is driving the allocation in the provision of funding to new ventures.

### 3 Start-up performance

Trailer et al. (1996) examined empirical literature regarding the measurement of performance in new ventures. The authors studied what kind and how dimensions of performance were measured. The growth of a new venture besides efficiency and profit were the most observed dimensions of performance. For many companies, the prevalent way to assess the performance of a business is to measure the return on investment (Morgan and Strong, 2003). Gilbert et al. (2006) found in their review that the most significant measurements of the growth of a start-up are the market share, employment and the sales of the company. The authors also note that it depends on the type of company and the industry in which the venture operates. Table 1 shows an overview of determinants of performance in the literature.

**Table 1** Overview of determinants of performance in the literature

<i>Author(s)</i>	<i>Focus</i>	<i>Determinants of performance</i>
Brush and Vanderwerf (1992)	66 manufacturing firms, 4-6 years’ old	Annual sales, number of employees, return on sales, growth in sales, growth in employees
Chandler and Hanks (1993)	120 manufacturing businesses, founded between 1980 - 1991	Growth, business volume
Morgan and Strong (2003)	149 high-technology, industrial manufacturing firms, medium and large companies	Return on investment, sales growth, market share, customer satisfaction, competitive position, customer retention
Wiklund and Shepherd (2005)	413 Swedish firms from manufacturing, professional services and retail, small businesses	Financial performance measures: cash flow relative to competitors, profit, sales;

				Growth measures: sales and employee growth, sales and employee growth relative to competitors
Hughes and Morgan (2007)	211	high-technology firms located within business incubators		Customer performance (customer acquisition, customer retention), product performance (sales, market share)
Wiklund and Shepherd (2009)	413	Swedish manufacturing, services and businesses	firms from professional retail, small	Employment growth, sales growth, sales growth compared to competitors, value growth compared to competitors

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It can thus be concluded that the most important determinants of performance in the literature are financial performance measures such as sales growth, employee growth, return on investment or cash-flow.

However, these metrics are not suitable if applied to an early-stage web, mobile & software start-up. The contextual dimensions in the growth literature are often neglected, therefore it is necessary to conduct more research on the entrepreneurial growth process (Wright and Stigliani, 2013). Coad (2010) looks at the growth of a firm as a multidimensional phenomenon, and views profits, employment, sales and labor productivity as substantially different indicators with individual information about venture growth. It is becoming more important to not only measure growth through different measurements of growth, but also to theorize different patterns of growth (Wright and Stigliani, 2013). Future research has to take not only ownership and size of the venture into consideration, but also other dimensions of heterogeneity of the firm, because those dimensions might help to define the relationship between financing and growth (Du and Girma, 2012).

## 4 Research Design

This research utilizes a qualitative and inductive explorative research design in the form of a case study. The research design phases are presented in Table 2.

Based on the literature review, we developed a framework to identify performance metrics which allow to assess performance in an early stage start-up company. The framework will be integrated into a questionnaire that will be applied in the case study research.

The case-study approach aims to establish the operational link between one set of conditions (causes) and their effects (Yin, 2003). Personal interviews with the entrepreneurs allow to obtain data on the entrepreneurial cognition and growth strategy, to theorize and discuss the performance quantifications.

**Table 2** Research design phases

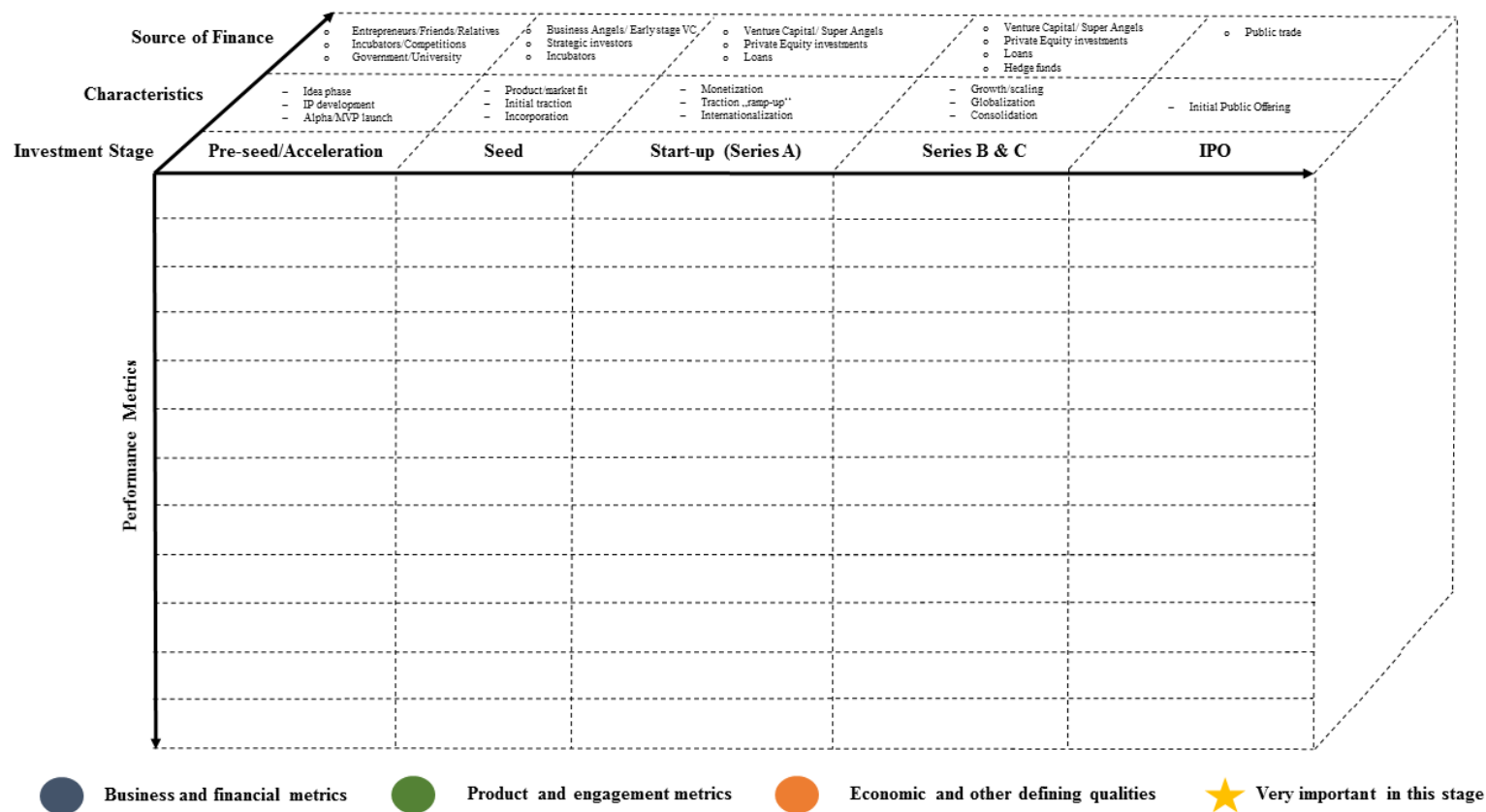
<i>Phase</i>	<i>Objective</i>	<i>Output</i>
<b>Phase 1</b>	Literature review of start-up performance	Start-up performance framework
<b>Phase 2</b>	Pre-test with CEO of a start-up	Feedback from an entrepreneur
<b>Phase 3</b>	Changes on the framework	Improved start-up performance framework
<b>Phase 4</b>	Interview with director of UPTEC	Suitable web, mobile & software companies in UPTEC to apply the research study
<b>Phase 5</b>	Conduct the case study with entrepreneurs	Sample of 10 start-up companies (selected in Phase 4)
<b>Phase 6</b>	Conclusions	Answer the proposed research questions

## **5 Research Findings**

The present paper will present the results of the first three phases.

Due to the lack of research on how performance in an early-stage web, mobile & software start-up can be quantified, a start-up performance metric framework was developed. The framework can be used to identify metrics and assess start-up performance in different investment stages /life-cycle stages. The framework adopted Yun et al.’s (2016) structure to collect data across different phases and was then tailored to link the investment stages, the performance measurements and the Sources of financing (Natusch, 2003; OECD, 2013). Figure 1 shows the structure to identify start-up performance metrics.

This paper was presented at The XXVII ISPIM Innovation Conference – Blending Tomorrow’s Innovation Vintage, Porto, Portugal on 19-22 June 2016. The publication is available to ISPIM members at [www.ispim.org](http://www.ispim.org).



**Figure 29:** Start-up performance metric guide

### *Characterization of TOPDOX*

TOPDOX is a start-up in the mobile sector that is incubated in UPTEC. It was founded in 2014 by a product and a graphic designer. TOPDOX offers a mobile application that allows the user to access, read, edit and share documents and to link multiple cloud accounts. In April 2016, TOPDOX employed 18 full-time employees.

Lee et. al.’s (2001) study investigated that the orientation of the entrepreneur has a statistically significant and positive effect on the performance of the venture. In order to explore the relation between performance and entrepreneurial cognition Lumpkin and Dess’ (1996) integrative framework was utilized. Proactiveness, innovativeness, competitive aggressiveness, risk-taking and autonomy are the five dimensions of the entrepreneurial cognition (Lumpkin and Dess, 2001).

**Table 3** Proactiveness

<i>Scale</i>	
<b>In dealing with its competitors, my firm ...</b> Typically responds to action which competitors initiate	① ② ③ ④ ⑤ ⑥ ⑦
Is very seldom the first business to introduce new products/services, administrative techniques, operating technologies, etc.	① ② ③ ④ ⑤ ⑥ ⑦
<b>In general, the top employees of my firm have ...</b> A strong tendency to “follow the leader” in introducing new products or ideas	① ② ③ ④ ⑤ ⑥ ⑦
Typically initiates actions which competitors then respond to  Is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc.  A strong tendency to be ahead of other competitors in introducing novel ideas or products	

Source: Lumpkin and Dess, 2001

**Table 4** Innovativeness



<i>Scale</i>	
<b>In general, the top employees of my firm favour...</b>	
A strong emphasis on R&D, technological leadership, and innovations	① ② ③ ④ ⑤ ⑥ ⑦
A strong emphasis on the marketing of tried-and-true products or services	
My firm, marketed in the past 5 years...	
Very many new lines of products/services	① ② ③ ④ ⑤ ⑥ ⑦
No new lines of products or services	
Changes in product or service lines have usually been quite dramatic.	① ② ③ ④ ⑤ ⑥ ⑦
Changes in product or services lines have been mostly of minor nature	

Source: Lumpkin and Dess, 2001

**Table 5** Competitive Aggressiveness

<i>Scale</i>	
My firm is very aggressive and intensely competitive.	① ② ③ ④ ⑤ ⑥ ⑦
My firm makes no special effort to take business from the competition	
<b>In dealing with its competitors, my firm ...</b>	
Typically seeks to avoid competitive clashes, preferring a “live-and-let-live” posture	① ② ③ ④ ⑤ ⑥ ⑦
My firm typically adopts a very competitive “undo-the-competitors” posture.	

Source: Lumpkin and Dess, 2001

**Table 6** Risk-Taking

<i>Scale</i>
<b>In general, the Administration of my firm has ...</b>

A strong proclivity for low-risk projects (normal and certain rates of return)	① ② ③ ④ ⑤ ⑥ ⑦	A strong proclivity for high risk projects (with chances of very high returns).
<b>In general, the top employees of my firm believe that ...</b>		
Owing to the nature of the environment, it is best to explore it gradually via timid, incremental behavior	① ② ③ ④ ⑤ ⑥ ⑦	Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm’s objectives.
<b>When confronted with decisions involving uncertainty, my firm ...</b>		
Typically adopts a bold posture in order to maximize the probability of exploiting opportunities.	① ② ③ ④ ⑤ ⑥ ⑦	Typically adopts a cautious wait-and-see posture in order to minimize the probability of making costly decisions

---

Source: Lumpkin and Dess, 2001

**Table 7** Autonomy

<i>Scale</i>		
My firm supports the efforts of individuals and/or teams that work autonomously.	① ② ③ ④ ⑤ ⑥ ⑦	In my firm, individuals and/or teams pursuing business opportunities have to constantly refer to their supervisor(s)

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Source: Lumpkin and Dess, 2001

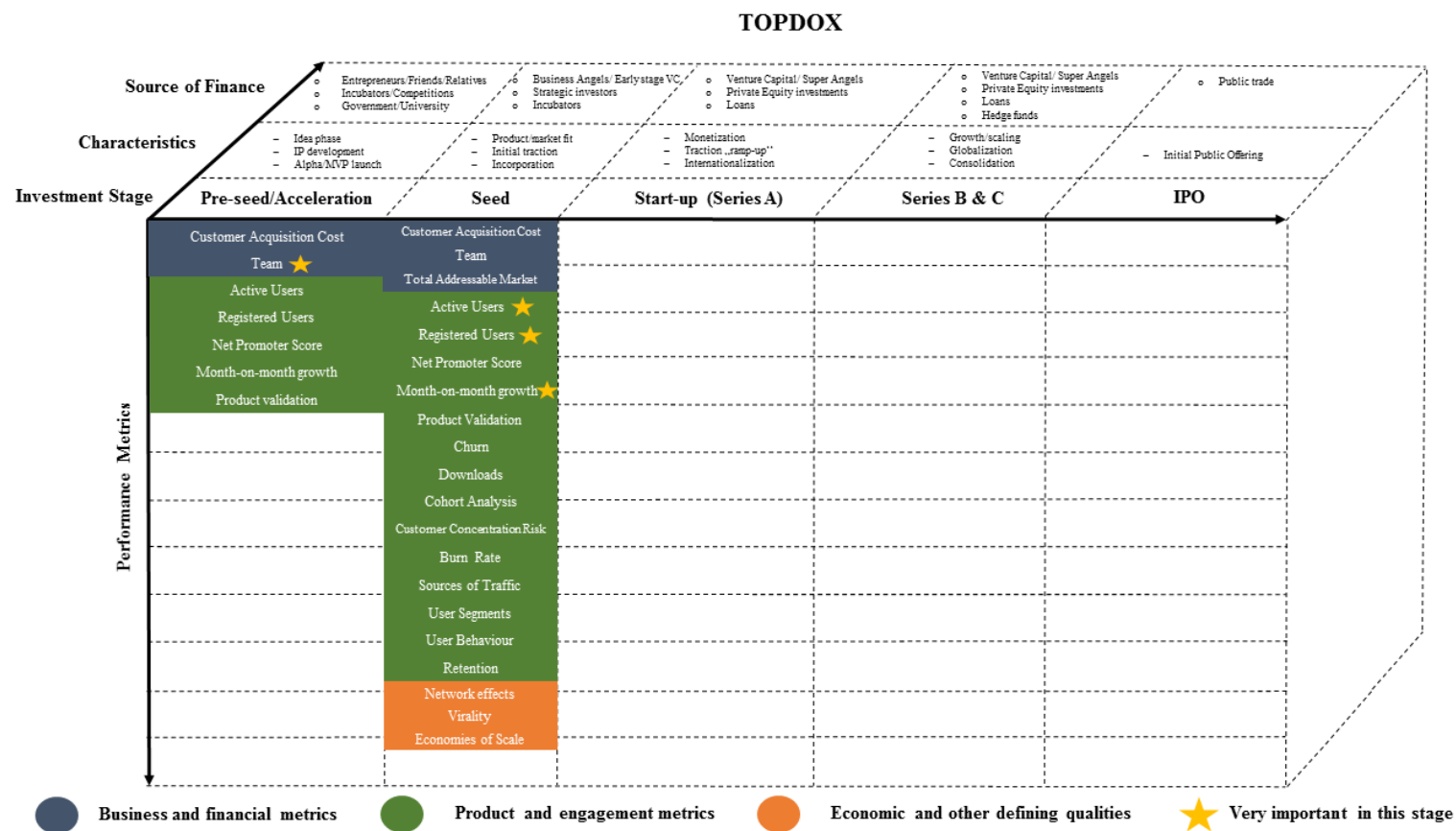
TOPDOX is a firm with a tendency towards proactiveness. In terms of innovativeness the firm was focused on one core product, which was subject to significant changes. TOPDOX is an aggressive and competitive firm and has a very strong proclivity for high risk projects. The firm also supports autonomous work of individuals. The founder and CEO of

TOPDOX recommends to have a technical co-founder. In his opinion, the optimal combination of co-founders for a web, mobile and software start-up is a business developer, a technical co-founder and a designer for product usability.

TOPDOX was in the seed stage in April 2016, incorporated, trying to validate its business model with initial traction of their product. The firm focused on increasing the amount of downloads of the application, but the entrepreneur concludes in hindsight, that the amount of downloads wasn't the most critical performance measurement. The entrepreneur noted that his firm should have measured user segments, user behaviour and retention from the very beginning. The entrepreneur also emphasized the importance of hiring the best talents and that for him the team is the most important performance measurement in the pre-seed/acceleration stage. In the seed stage the most important measurements were active & registered users and the month-on-month growth of the amount of users.

Figure 2 shows the different performance measurements that were utilized by the entrepreneur.

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**Figure 30:** Start-up performance metric framework based on answers from TOPDOX

The venture is financed through bootstrapping (own money) and venture capital. In the mind of the entrepreneur, there were significant changes in the entrepreneurial cognition after obtaining venture capital. Obtaining venture capital created “bigger challenges” with the “focus on growth” and the entrepreneur felt that he is “running against time”. However, the entrepreneur stated that venture capital had an advantageous in boosting performance for his firm.

### *Conclusions*

This boost in performance comes mainly from experienced VC’s who added value to the start-up through management guidance (Baum and Silverman, 2004). The entrepreneur noted that not only the amount of raised capital is important, but also the Source of financing.

We validated the interview guide, which will be applied in the next phases of the research. Based on the pre-tested interview, we confirm that the most important performance metrics are not related with financial metrics such as revenue, sales or return on investment.

To build a universal tool to assess start-up performance in all stages of development, we have to take into consideration that the guide has to be parameterized according to the different start-up stages.

For future research, the start-up performance metric framework should be applied to a sample of web of at least 10 mobile & software start-ups, to identify the impact of the Sources of financing and to determine the most important performance measurements in each investment stage.

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### **Areas for feedback & development**

We are open to receive feedback about the universality of the start-up performance metric framework and the importance of the topic regarding the concepts and the management of the different sources of financing. It would be also interesting to replicate the study in different ecosystems/industries and to get some inspirations from industry executives/entrepreneurs or innovation researchers to explore new directions and tendencies in this area.